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Volume Are Advertisements

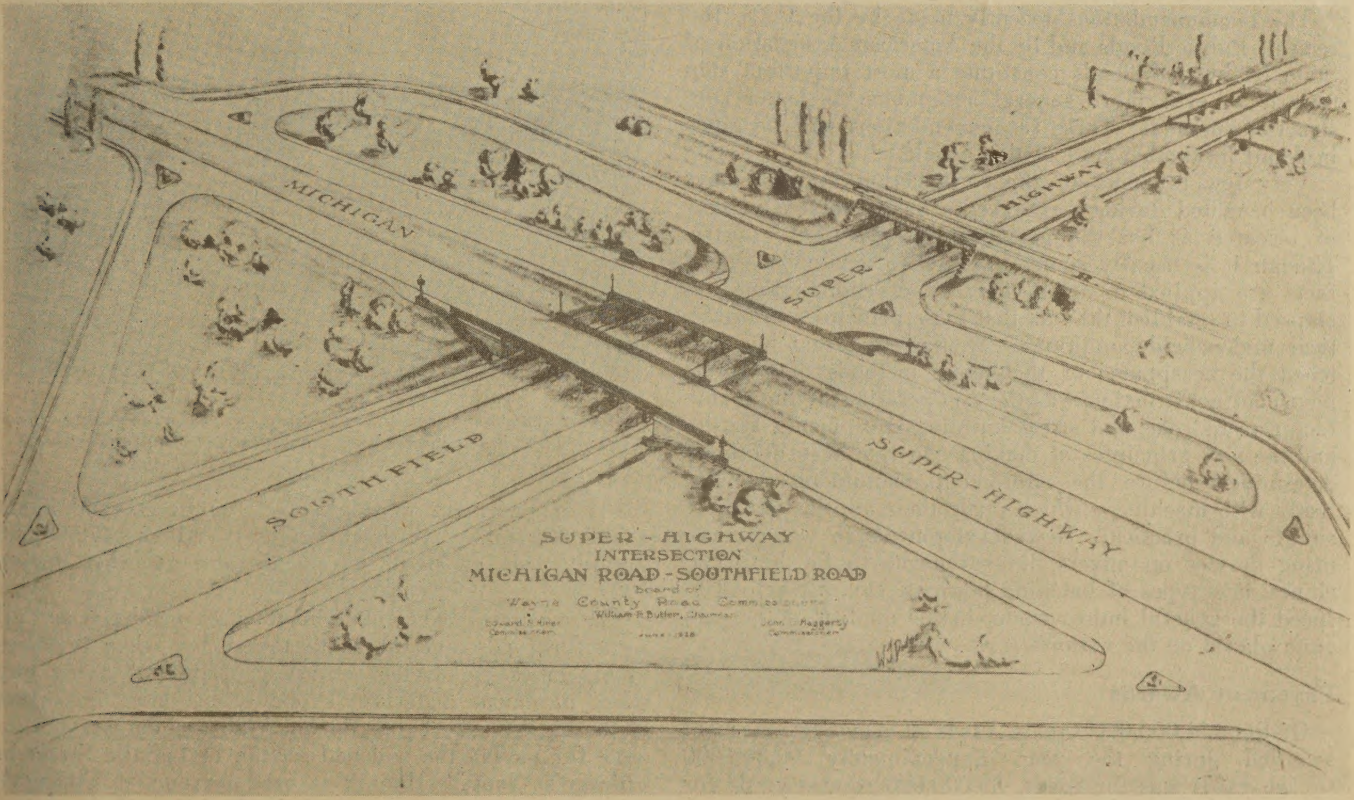
Concrete

Vol. 34 Chicago, January, 1929 No. 1

1928 Accomplishments in Concrete Pavement Construction

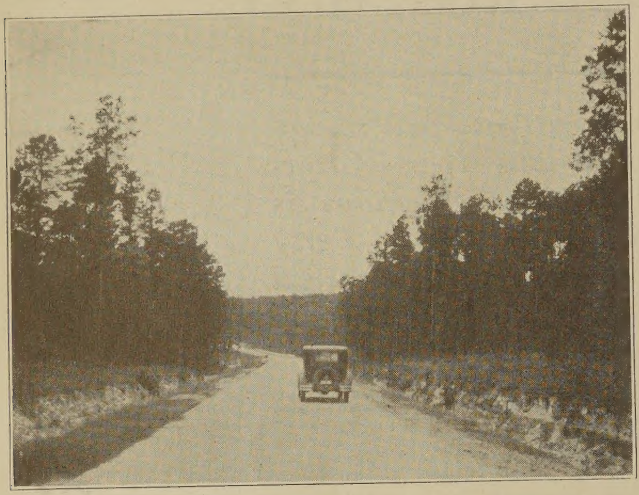
Yardage of Concrete Pavement Awarded Shows Greater Gain Than Any Previous Year—Growing Adoption of Quality Control Methods is Year's Greatest Accomplishment—Use of Early Strength Concrete Increases—Trend is Toward Proportioning by Weight—Some Possible Future Developments

AGAIN, in 1928, a new mark has been set in the volume of concrete pavement awarded during the year. A conservative estimate places the awards for the year at 144,000,000 square yards—an increase of approximately 18,000,000 square yards over the 1927 awards. Thus another year is added to the record which shows that each year since 1923, the total annual awards exceeded those of the previous year. And the increase for 1928 was 50 per cent greater than the 1927 increase of 12,000,000 square yards.



The all-modern highway—wide, two-lane roads, with intersecting grades separated. This grade separation is a 1928 project in Wayne County, Mich.

Another indication of progress of equal, if not greater importance, was the growing recognition of the need for quality construction. Throughout the United States, in the construction of country highways and city streets, greater care was exercised to secure pavements with more even surfaces and a better quality of concrete. State highway departments have for some years been emphasizing quality construction. Some cities, also, had been placing concrete pavements under the modern methods of quality control, but it is only in the last few years, notably 1927 and 1928, that the use of the newer methods had been more generally employed for street construction. Some progress in this regard was made during the year just passed, but there are still all too many cities and villages where improvements in construction methods are urgently needed.



A section of State Highway 43, in Anderson County, Tex., built during 1928. Texas awarded 600 miles of concrete paving contracts during the past year

The recommendations recently made by the U. S. Bureau of Public Roads and by the American Association of State Highway Officials constitute a most important step toward an even more general acceptance of better construction methods. These recommendations will be given in detail in another part of this article.

Very few branches of the construction industry have been benefited during recent years by as great a volume of research as has the pavement construction industry. Though it is usually some time before newly developed facts are applied to actual field work, enough time has elapsed to establish the fact that these principles are practical under field conditions. Another fact that has hastened the acceptance of the newer methods of concrete pavement construction was the co-operation of the manufacturers of road and street building equipment. Hardly had the new principles of making concrete been definitely determined before the equipment manufacturers were ready with machinery which made their application more simple and practical. New developments in water measuring devices on mixers, improvements to finishing machines, new types of batching hoppers, etc., all helped to speed the general improvement in the quality of the concrete placed on the nation's traffic ways.

Pavement Awards

Of the 144,000,000 square yards of concrete pavement awarded during the year, approximately 90,000,000 square yards was for roads, 50,000,000 square yards for streets and 4,000,000 square yards for alleys.

Figured on a basis of a width of 18 ft., the 90,000,000 square yards of awards would add about 8,500 miles to the concrete highways of the United States, but since a considerable portion of this yardage was for widening existing highways, and since much of the pavement was wider than 18 ft., the actual increase in length would be more nearly in the nighborhood of 8,000 miles.

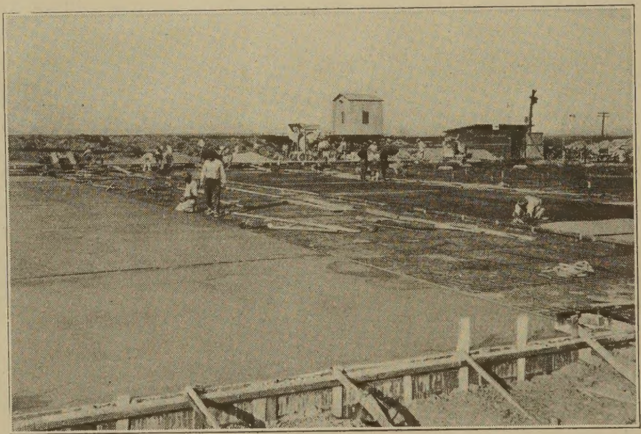
Awards were fairly evenly distributed throughout the United States, each section contributing to the general development. Illinois again, as in 1927, holds the honor of having built the largest mileage of concrete roads. During the past year, contracts for approximately 1,200 miles of concrete pavement were awarded in Illinois, as against 780 miles in 1927.

New York again follows Illinois, this year with about 800 miles of new awards. Michigan placed an equal mileage of pavement under contract and Texas comes fourth with approximately 600 miles. Iowa maintains its last year's pace with about 500 miles, followed by Pennsylvania with 450 miles, North Carolina with 350 miles and Wisconsin with 300 miles.

There has been a tendency to award single contracts for longer stretches of pavement than in the past. This policy makes for convenience in handling contracts and enables contractors to buy equipment and organize their work more effectively. Another trend in the awarding of contracts is the more rigid investigation of contractors, not only from the standpoint of financial responsibility, but from the standpoint of past performance. As has been the case in the past, a portion of the construction is concentrated on the main through routes, though this will probably be more pronounced in next year's work. Noteable examples of contracts aimed at completing entire highways are found in Missouri and Illinois.

Municipal Awards

Street and alley concrete pavement awards continue to increase. During the past year about 50,000,000 square yards of pavement were awarded for streets and about 4,000,000 square yards for alleys. About 47,500,000 square yards of street pavement were awarded during 1927.



Airport pavement construction grew in volume during the year. This illustration shows the construction of a concrete driveway at the Kansas City municipal airport

The concrete pavement is no longer considered as "all right for roads and for small towns, but when it comes to big cities—." It has definitely arrived as a big city street pavement material. Probably the most important of the big city street jobs during 1928 was the use of concrete for paving the widened section of LaSalle Street in Chicago's "loop." Here it is used on one of Chicago's most important business streets in the heart of the downtown business section, adjoining the city hall and court house.

Other important street pavement jobs were the Hutchinson River Parkway in New York City which was paved with concrete during 1928, and the boulevards leading to the new Delaware River bridge in Camden, N. J. As was the case in 1927, a large portion of the street contracts were awarded in the larger cities. The use of high early strength concrete for intersections and for important bottlenecks permitted the opening of the streets within a few days after the concrete was placed and thus removed an important objection to the use of concrete on such jobs.

Airport Paving

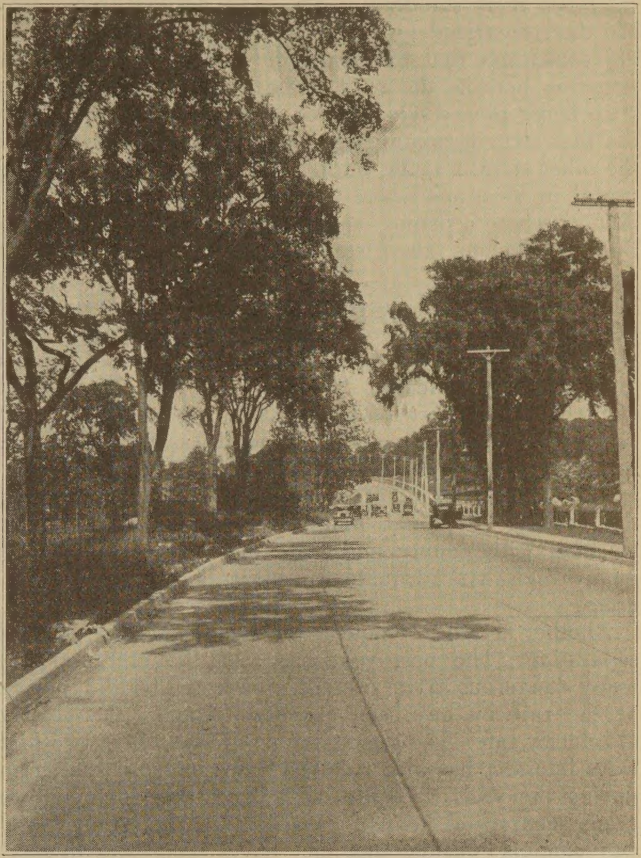
A lusty new youngster has appeared in the concrete pavement family—and his name is airport paving. Following Col. Lindbergh's historic flight across the Atlantic, popular enthusiasm for airport development began. Plans were made for the establishment of scores of municipal and private airports. But funds were not made available until within the last year or two and the development of airports has only just begun.

Yet, even while this branch of the industry is still very much in its infancy, one estimate places the consumption of cement for use in airports at around 100,000 barrels. Concrete pavement has been used for hangar floors, aprons, pavement around buildings, drives, etc., and during 1928 the first all concrete runway was built at the Ford airport near Detroit (see November issue, page 31). So successful has this proved that another similar runway is now under construction at this airport and other fields are laying plans to follow suit. With the rapid progress now being made in aviation, an important new field is opening up for concretors. A total of almost $21,500,000 was voted by municipalities during the year for new airport construction.

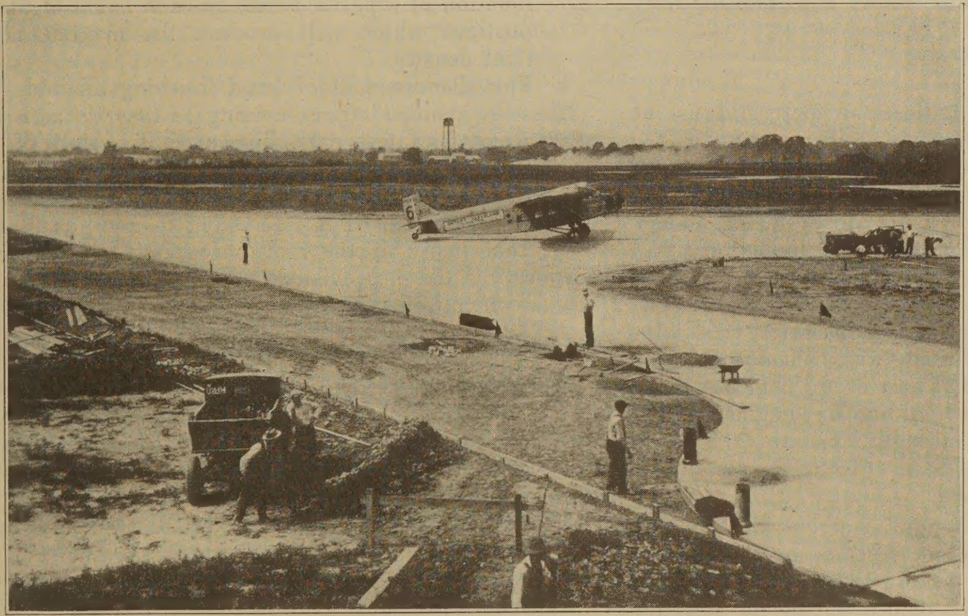
Pavement Width and Thickness

One of the outstanding developments of the year was the large amount of highway widening and modernization under way, especially near the larger cities. Though little new has been developed in pavement slab design during the past year, the trend toward the use of the thickened edge type of pavement and the use of thicker slabs on the heavier traveled highways continues. More and more the pavement is being adapted to the traffic it is expected to bear instead of being designed on a hit or miss basis. Pavement engineers are finding that such a procedure effects important economies in maintenance costs and in longer useful life.

In many localities, both streets and highways are being



The Boston Post Road in Westchester County, N. Y. Many highway widening projects, like this one, featured the 1928 highway program



The first concrete runway in the United States was built during 1928 at the Ford airport at Dearborn, near Detroit, Mich.

built in two or more 10-ft. strips. Under this plan each traffic lane is computed as 10 ft. wide and the pavement width is a multiple of this single traffic lane width. Most state highway departments are using 20 ft.—a two-lane road—as their standard width. The various traffic lanes are then separated by a construction joint and the strips are sometimes tied by means of dowel bars. Such construction permits the road to be built half-at-a-time, one strip being placed while traffic uses the other side. When the first strip is completed, traffic is turned onto it while the other strip is being built. This method is particularly useful in locations where adequate detours are not available or where a detour would cause undue inconvenience. Such pavements also lend themselves easily to future widening.

Widening of existing highways or the construction of new, multiple lane roads was active during 1928. In the vicinity of New York City, Buffalo, Philadelphia, Cleveland, Detroit, Chicago, Memphis and Los Angeles the work of providing wide highways has been pushed. Several of the counties in which large cities are located have undertaken programs which have as their aim the widening to at least 40 ft. of every main traveled highway in the county. Regional planning organizations are also working with county and state officials in an effort to secure highways adequate for the traffic of metropolitan areas.

Another activity of note is the steady increase in grade separation. The past year has seen the elimination of many dangerous grade crossings where either the highway or the railway has been elevated to make the crossing absolutely safe. The separation of grades where two highways intersect has also received more immediate attention during the year. In spite of the fact that such highway grade separations involve a considerable investment, highway officials consider that they effect economies in facilitating the movement of traffic to such an extent that they warrant the expenditure. Wayne County, Michigan, presents some notable examples of this work. Other such grade separations may be found in Chicago and New York, and plans are under way to extend the use of them to some of the more important county and state highway intersections.

High Early Strength

Reports from many states indicate an increasing use of high early strength concrete where early opening of the pavement to traffic was necessary or advisable. In most cases, the higher early strengths were secured with the use of standard portland cement, using richer mixes, longer mixing time, admixtures, etc., though a number of cases were reported where special cements were used. In both cases the quality of the concrete secured was reported as satisfactory and the additional cost of the work, especially when special cements were used, was considered to be only as much as the additional cost of the cement. Similarly, it was reported by some highway-engineers that the cost of using high early strength concrete with standard portland cement was increased only by the amount of the additional cement required.

The use of high early strength concrete has, for the most part, been confined to intersections or to stretches of pavement where it was necessary to allow traffic to cross the road or to the work placed during the last few days' run on a pavement job. Usually, also, the use of this type of concrete was limited to locations near cities where traffic delays are expensive. An example of the use of high early strength concrete is found in the $15,000,000 highway program in Cook County, Ill. Here high early strength concrete, made with standard portland cement, was used for all important intersections and in some cases for completing the last few days' run. Ordinarily an entire new stretch of pavement is kept closed to traffic to permit the concrete placed during the last week to harden. When these last few days' work is built of high early strength concrete, the pavement may be turned over to the users in a much shorter time and the additional cost is more than justified.

Another outstanding use of high early strength concrete during the past year was the rapid construction and use of a highway in northern Wisconsin which was rushed to completion so that it could be used by the traffic resulting from President Coolidge's visit to that country for his summer vacation. (See July issue, page 48.) The use of early strengths for highway repair and maintenance is not new and has become almost standard practice in many states.

U. S. Bureau of Roads Recommendation

As mentioned before, perhaps the most important developments of the year from the standpoint of construction, were the recommendations of the U. S. Bureau of Public Roads and the American Association of State Highway Officials.

Though the U. S. Bureau of Roads has always encouraged quality concrete for pavement construction, it has never previously come out with a definite recommendation, stating the method it prefers. The following announcement, therefore, presenting the principles which the Bureau will "actively encourage," is of unusual importance:

1. The abandonment of volumetric proportioning of aggregates and the adoption of proportioning by weight. Inundation will be recognized as a permissible alternate method for fine aggregate, but weighing will be preferred.
2. Maintenance of the lowest water-cement ratio which, with the type, grading and proportioning of aggregate and methods of finishing employed, will produce a workable, dense, and uniform concrete.
3. The scientific grading of coarse aggregate by combination of separated sizes in each batch in the proportions which will produce the maximum practical density.
4. The abandonment of hand finishing methods.

These recommendations, coming as they do as a result of research and test extending over a period of three years, are of unusual importance. They are released by the Bureau in an effort to improve the quality of concrete used in pavements. It is interesting to note, as is shown later, that many of the more progressive states are incorporating these provisions, or similar ones, in their new specifications.

A. A. S. H. O. Recommendation

In presenting its approved 1928 standards, the American Association of State Highway Officials also influences the trend toward better construction and design practice. Some of the recommendations that directly affect concrete pavement construction are given below:

1. Each traffic lane should be at least 10 ft. in width.
2. Thickness of concrete pavement should be a minimum of 6 in.
3. Where possible, shoulders along the edges of pavement should have a width of not less than 8 ft.
4. Some suitable form of construction joint should be used to divide the pavement longitudinally and dowel bars should be installed across the joints between sections.

(Continued on Page 48)

Just What Does Winter Work Cost?

A Detailed Analysis of Construction Costs Covering a Period of Four Years — Comparison of Summer and Winter Costs—Some Pertinent Conclusions

In this article, a veteran general contractor analyzes four years of experience with winter construction. A careful tabulation of the results, taken from a cost system designed to point out the differences in cost of winter and summer work, is the basis for the conclusions given.

Because of the frankness of the discussion and the presentation of actual costs and other statistics taken from his records, it is only natural that the author prefers not to have his name or the name of his company published.

An interesting fact in connection with this study is that the firm whose experiences are given is a general contracting organization doing all types of construction work. Yet the amount of concrete work completed was of sufficient importance to make the savings noted possible.

IN 1924 a committee of the President's Conference on Unemployment published a book on "Seasonable Operation in the Construction Industries." Chapter Eight indicates some of the advantages and disadvantages of winter construction to the general contractor. In view of this discussion it has been interesting to examine the experiences of a general contracting organization doing business in the northwestern states.

Neglecting the intangible economies of purchasing materials and sub-contracts during the off season and the intangible economy of continuous labor operation, it is more economical to obtain winter contracts and absorb the cost of winter protection than it is to close down the general contracting organization for three months. This is the conclusion reached from such an examination.

Four Years of Winter Work Analyzed

Table I, on the following page, is a summary of contracts completed between January 1, 1924, and January 1, 1928. The work completed under these contracts represents a very diversified field, covering factories, creameries, garages, schools, hospitals, theaters, commercial buildings, and residences. Forty per cent of the total volume of business was handled by the contractor's own organization and the balance was sublet. The contractor did all of his own concrete, masonry, and carpenter work.

The costs were accurately kept and checked against the original estimates and the book accounts every two weeks. Each cold weather job was furnished with a special winter code. The following is a copy of such a code as sent to the field office:

For all work peculiar to winter conditions such as laying steam lines, firing boilers, and salamanders, erecting canvases, etc., use the capital letter W as a prefix as:

WPeb—Winter Plant erecting boiler

Use the following code:
- a—preparing
- e—erecting
- i—removing
- o—firing (for boilers or salamanders)

Use following third letters under Plant:
- b—boiler
- f—salamanders
- k—canvases
- q—snow and ice

Removing snow from forms would be:
WFiq

Erecting canvases would be:
WPek

Report coal and coke received for winter work specially noted on receipt slips.

When the job is completed, we wish to have the following costs:
- Temporary Protection (Materials and Labor)
- Tarpaulins—
  - Cost
  - Salvage
- Temporary Heat—
  - Salamanders
  - Coke
  - Labor (Salamanders)
  - Boiler Attendance (Labor)
  - Coal Boiler (Heating)
- Temporary Light (Labor and Service)
- Snow Removal

WPey (covering concrete with hay or straw).

All of the figures in Table 1 were taken from the contractor's cost records. The contractor's overhead was $75,000 per year.

TABLE II

Average Number of Men on Pay Roll per Month—January 1st, 1924, to January 1st, 1928

Month	1924 No. Men	1925 No. Men	1926 No. Men	1927 No. Men
January	387	315	423	637
February	215	381	301	542
March	132	497	293	487
April	115	522	277	416
May	225	509	314	380
June	198	457	378	384
July	120	440	404	432
August	169	458	525	365
September	178	594	523	361
October	291	572	578	343
November	340	628	540	421
December	408	598	591	314
Monthly ave.	231	498	404	423
Ave., Nov.-Mar.	296	485	429	480

TABLE I

Summary of Contracts Completed Between January 1st, 1924, and January 1st, 1928

Contract Number	Amount of Contract (Dollars)	Cu. Yds. of Concrete	Cost of Concrete, Materials and Labor (Dollars)	Cu. Yds. of Concrete Poured, Nov. to March	Sq. Ft. of Forms	Cost of Forms, Material and Labor (Dollars)	Winter Plant Costs			Total Winter Plant Costs (Dollars)	Ratio Winter Costs to Total Contract (Increase)
							Material (Dollars)	Labor (Dollars)	Fuel (Dollars)		
1924—1	273,000	2,360	25,000	31	107,000	9,000	—	—	—	—	—
2	68,000	710	7,150	90	26,000	2,800	15	—	—	15	—
3	22,000	300	3,000	—	3,000	300	—	—	—	—	—
4	233,000	3,243	29,500	2,445	122,700	19,700	301	2,043	1,296	3,640	.0155
5	46,000	700	6,700	186	19,000	3,300	—	119	—	119	—
6	60,000	630	5,500	489	23,400	3,200	100	936	1,008	2,044	.0334
7	307,000	3,134	30,800	2,712	183,000	23,900	2,000	2,138	2,400	6,538	.0213
8	57,000	793	8,100	793	31,400	5,600	548	465	280	1,293	.0227
1925—1	240,000	2,042	18,500	—	80,660	12,500	—	—	—	—	—
2	15,000	100	1,000	—	2,400	400	—	—	—	—	—
3	644,000	8,405	100,000	1,963	307,200	71,000	515	4,752	2,700	7,967	.0124
4	11,000	542	4,600	346	14,000	2,500	—	—	—	—	—
5	196,000	2,198	24,500	237	87,000	20,000	—	159	184	343	—
6	25,000	136	1,350	—	3,300	580	—	—	—	—	—
7	18,000	206	2,000	—	9,600	900	—	—	—	—	—
8	282,000	2,692	24,000	778	176,000	34,000	208	103	71	382	—
9	31,000	280	3,000	72	8,000	1,700	74	155	95	324	—
10	612,000	5,716	62,600	3,598	250,000	54,600	378	4,867	3,268	8,513	.0139
11	138,000	1,031	8,000	519	46,000	7,100	5	1,484	435	1,924	.0139
12	33,000	300	1,460	—	20,000	2,800	10	300	50	360	.0109
13	14,000	250	2,600	250	14,000	3,000	63	200	70	433	.0309
14	15,000	300	3,000	300	8,000	1,800	138	167	—	305	.0203
15	14,000	205	1,800	250	1,500	900	18	—	—	18	—
16	24,000	200	1,700	200	—	—	—	110	220	330	.0137
17	42,000	251	2,200	251	5,200	2,300	51	917	191	1,159	.0276
1926—1	30,000	253	2,400	253	5,000	900	21	150	15	186	.0062
2	157,000	1,041	7,400	6	24,000	4,200	—	17	136	153	—
3	188,000	2,035	17,000	500	47,000	8,300	16	990	458	1,564	.0082
4	68,000	764	7,000	2	11,000	1,400	—	—	10	10	—
5	98,000	1,530	13,200	804	84,000	13,200	150	1,950	958	3,058	.0312
6	415,000	21,270	143,603	11,059	403,000	73,609	720	5,655	3,793	10,168	.0245
7	102,000	1,202	10,300	984	21,000	5,600	154	767	567	1,488	.0146
8	23,000	417	3,500	417	25,500	3,500	162	163	14	339	.0147
9	594,000	6,156	31,100	1,093	118,200	32,000	331	1,678	669	2,678	.0045
10	216,000	1,900	15,500	1,112	75,000	11,100	295	900	714	1,909	.0088
1927—1	37,000	2,090	16,200	2,090	64,000	8,500	—	381	99	480	.013
2	32,000	602	4,400	—	27,000	4,400	—	—	—	—	—
3	40,000	285	3,300	—	10,000	2,400	—	—	—	—	—
4	11,000	250	1,300	—	6,000	1,000	—	—	—	—	—
5	37,000	260	4,500	—	12,000	4,500	—	—	—	—	—
6	324,000	3,000	24,000	704	120,000	21,600	40	541	577	1,158	.0036
7	74,000	1,250	11,000	350	39,000	10,000	11	783	417	1,211	.0163
8	108,000	1,550	14,000	300	38,000	5,700	23	925	339	1,287	.0120
9	45,000	475	5,000	190	14,000	1,700	—	55	64	119	—
10	81,000	411	2,600	342	18,000	4,000	100	542	330	972	.0120
	$6,100,000	83,465	$715,363	35,716	2,712,060	$501,489	$6,447	$34,402	$21,428	$62,277	.0102
			501,489				34,402				
							21,428				
			$1,216,852								
							$62,277				

Overhead equals $75,000 per year.

NOTE: Cost of winter protection per cu. yd. of concrete cannot be derived from this table because winter costs include more than protection of concrete.

Year Round Employment

Table 2 shows the average number of men on the pay roll for each month from January, 1924, to January, 1928. This table shows that the average number of men on the pay roll per month was greater for the five months of cold weather for 1924, 1926, and 1927, than for the monthly average. In 1925 the difference is very small. These figures show that the distribution of labor over the twelve months of each year was not affected by the weather conditions. The slump each spring was primarily due to the high competitive conditions of the spring market making it seem unadvisable for the contractor to go after contracts at that season of the year.

Table 3 is merely inserted here to show the small amount of concrete equipment required when the work was evenly distributed throughout the year. It was interesting to note the small investment required in winter equipment.

TABLE III

Showing Relation of Cost of Equipment Required for Winter Work to Total Plant Cost

10 concrete mixers	$11,700.00
40 concrete buggies	1,140.00
50 wheelbarrows	495.00
150 shovels	165.00
50 tampers and miscellaneous tools	50.00
1000 ft. rubber hose	140.00
Lumber, shores, runways	2,000.00
Towers	3,500.00
Chutes	1,562.00
Hoists	3,600.00
Bins and hoppers	1,720.00
Crane	4,000.00
	$20,072.00
6 boilers	$1,400.00
Canvas	2,000.00
Salamanders	840.00
Steam hose	500.00
	$4,740.00

From the above information the following facts may be deduced:

1. If the same volume of business had been handled on the basis of closing down for three months each year, it would have taken five years to complete an equal volume. The total overhead would then have been $375,000.

2. If winter protection had been considered as an overhead cost, the total overhead for the four years would have been $362,000.

3. The savings resulting from continuous operation instead of closing down would have amounted to $7,000.

4. Had the same volume of business been handled in nine months, it would have necessitated increasing the office personnel, equipment and capital. The overhead would then be increased by $20,000 per year, making the total overhead $380,000.

5. There are additional economies due to the increased efficiency of labor during the winter months and through the offer of continuous employment to labor.

6. There are additional economies due to purchase of material and sub-contracts during the dull season.

7. *It is not necessary for a general contracting organization to change its bidding prices with the seasons of the year.*

Road Builders Announce Details of Program

From an advance program released by the American Road Builders Association for its 1929 convention and road show at Cleveland, Ohio, Tuesday to Thursday, January 15th to 17th, it is seen that a general session, city officials' and constructors' sessions will occupy the first day of convention. The first discussion scheduled is "Trend of City Government," followed by the report of the committee on administration, organization and finance of the City Officials' division.

This will be followed in the afternoon by the city officials' session with an address by H. C. Whitehurst and reports of such committees as those on Design and Construction, on Subgrades, Foundations and Bases for Pavements, and on Maintenance and on Traffic.

The constructors' session are to be held at the same time and here are to be presented three papers, on "Trend of Construction Equipment Design"; report of the committee on "A study of Liens in Public Construction," and "Prequalifications of Bidders on Public Construction Work."

A Pan-American session precedes those for engineers and for constructors, the latter two being simultaneous. Those sitting in among the engineers will receive first the report of the committee on Depreciation of Equipment, followed by "Practical Applications of Recent Highway Investigations," and two more committee reports, on Finance and Grade Crossings.

The constructors are due to discuss such subjects as "Recent Changes in Pavement Design and Specifications and How They Affect the Contractor," "The Economics of Grading and Paving Operations," as well as "Do Construction Costs Justify Present Low Bidding."

County highway officials' sessions are scheduled to occupy the entire following day, the 17th, when T. J. Wasser, president of the organization of these officials will deliver an address. The single paper scheduled for the morning session is entitled "Procedure for Making an Economic Survey and Plan for County Highway Development." Four reports, on surveys and planning, county highway construction, rural county highway mantenance, and urban county highway maintenance, are to be delivered at this time also.

County problems having to do with highway legislation, administration, construction and maintenance equipment and highway finance will be covered in the four papers scheduled for the afternoon, and last, session.

Tests Disclose Fineness of Anhydrite Has Strong Effect on Plasticity

Experiments made at the New Brunswick, N. J., experiment station by the Bureau of Mines in connection with the utilization of anhydrite as a retarder for portland cement disclose that the type of anhydrite has little importance, although its fineness has a strong effect upon the plasticity of the cement. Many gypsum deposits are contaminated with anhydrite to such an extent as to make the mineral unsuitable for use in the manufacture of calcined gypsum products and it was the problem of disposing of this material that led to the tests made by the bureau.

An earlier report in this study gave a comparison between the action of anhydrite and gypsum but, since the physical properties of natural anhydrite vary to a considerable extent, the work was extended to determine the effect of the type of anhydrite and its degree of fineness on its action as a retarder.

P. G. RILEY
President

P. G. RILEY
GENERAL CONTRACTOR

T. G. McGOVERN
General Supt.

~~701 Temple Street, Pittstown, N. Y.~~

Los Angeles

Dear Ann:

Well, here it is New Year's and I have to acknowledge the most interesting Christmas remembrance that anybody thought to send me—something out of the old office files at home and it sure looked good to me.

It was mighty thoughtful of you to dig up that old print of my first job and have it framed with the swell hand colored enlarged picture of the Union Station job, the most recent achievement of the P. G. Riley organization. And at the bottom everybody signed—everybody put their scrawls, from you and Mac down to Tony's mark.

I just tilted that frame up on the table in the "solarium," or whatever Ma calls the little two-by-four room here with all the windows and I let my mind riffle back through the files of memory until I had a lump in my throat. Got to thinking of all the downright honest-to-God human beings I'd rubbed up against in my time as a contractor.

Sitting there looking at those pictures like a love-sick youth with peach fuzz on his chin I could hear the sound of the hammers again and the snort of the shovel and the whiz of the bucket as Pete shot her up the tower and the sing of the concrete as it scurried through the chutes. All the old familiar noises. No, not noises—music. Music more penetrating and far-reaching than radio because it spanned time as well as distance. Sort of a movie-tone it was, because with the music I got a moving picture of all the old operations.

Am I getting mushy? Never mind, it's the holiday season and you can allow me to get this way once a year.

They say contracting is a cold-blooded business where men are only the grist poured in by the contractor so he may take out money. Maybe so. I've hired men and fired 'em and cussed 'em and damned 'em but more than money has come out of the old Riley mill. This I know. Some chaff maybe but a great deal of good stuff as well. Men who have gone out and made good.

Why, girl, I could go back east and tramp past a lot of damn fine buildings, beautiful things that architects designed to reach skywards and rest as monuments for years and years—buildings that P. G. Riley and his gang put up and put up to stay. Proud of every one of 'em. But I'm prouder of a lot of other monuments. They're the men who have worked with me, in the day and in the night, under sun and sleet, men who took all my ornery-mindedness without killing me and who, when I praised them, just spit a coupla times and got red in the face.

Brains and man power can be bought like equipment but it has paid me to get this raw material in man power and make producers of it, and tie men to me by more lasting bonds than money.

I just got to thinking of this letterhead I'm using. What does P. G. Riley at the top mean? Not a loafing old contractor trying to kill time decently in this moving picture climate on the coast. It means Mac and Ann Ryan and every superintendent and the colored boys who push the buggies and every last son-of-a-gun down to the water boy who generally isn't around except when the pay clerk's shanty window opens. That's what makes any building organization—the human beings in it and the more human they are and the more teamwork they develop the better their jobs go. "Morale" they call it in the army.

Well, that's that. I'm probably just a soft old fool who'd only be in the way if he were back on the job but those pictures you sent sure started the old memory functioning and, being Irish, I reckon I ran over. Anyway, Happy New Year to you and Mac and the boys and I'll try to leave you alone for a month or so.

Yours to a cinder,

P G

This is the eighth letter of a group whose publication began in the May issue of Concrete *written by P. G. Riley, retired contractor, to his superintendent, Tom McGovern, back home. "P. G." is taking his ease in California and the distant fields, where he was once so active himself, look mighty green now.*

Perhaps his greatest pleasure is in keeping in touch with his superintendent and, off and on, his secretary, Anna Ryan. His being away from the scene of activity has given P. G. some new viewpoints and he manages, in his letters, to convey to the young folks some of the ideas in the back of his head. One of the bits of advice he has already given "Mac" concerned the wisdom of investigating operating performance when buying equipment. At another time he told Mac of the "catch" in the seemingly attractive trade-in offer. There's a lesson, too, he said recently, in not letting old, inefficient equipment eat up the profits.

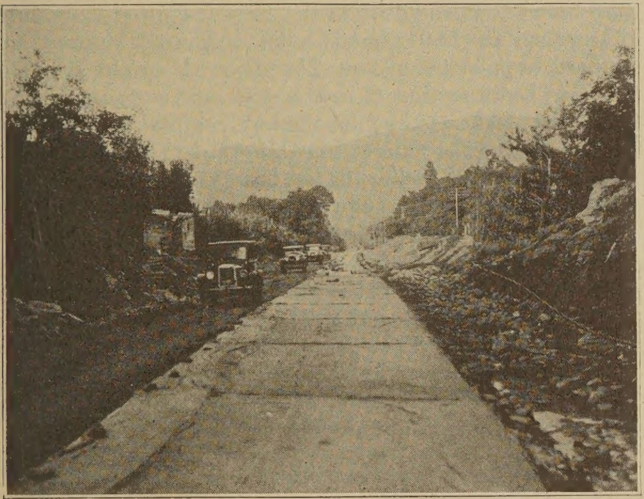
That there's a fallacy to purchasing the lowest priced equipment offered, "P. G." discovered to his own enlightenment when spurred into looking into the subject by a little incident, he told "Mac" in a later report.

"P. G." addressed his next letter to Anna Ryan, his secretary, who, evidently alarmed at Mac's somewhat rash participation in bidding for jobs, wrote Riley about the matter. His December letter went to Mac and in it "P. G." repated a little story told him by a friend about buying equipment on a quality and performance basis—or in his own words, "machines should be picked out like they used to pick horses."

Connecticut Modernizes a Mountain Road

New Concrete Pavement Reduces Grades and Improves Alignment on Rebuilt Southington Mountain Road

ONE of the most interesting small road projects completed by the Connecticut State Highway Department in 1928 was the relocation and paving of the Southington Mountain road between the towns of Southington and Wolcott. This road has always carried a heavy traffic and of late has been used extensively by heavy busses running between Hartford and New Haven. The old road had bad curves and in places a grade of 12 per cent. Under the heavy traffic the road became very rough and required constant maintenance to keep the surface in usable condition.



The pavement was placed in two 10-ft. slabs, thus permitting of one-way traffic during construction

Grades Reduced

When the repaving came up it was decided to relocate the road to eliminate the curves and to reduce the grades. Approximately 75 per cent of the new road is relocation. As a result of relocation there are now 5200 ft. of tangent in the 8600 ft. of road. From an engineering standpoint the most interesting feature of the new road is the fact that the 5200 ft. of tangent is on a continuous grade of 9.8 per cent.

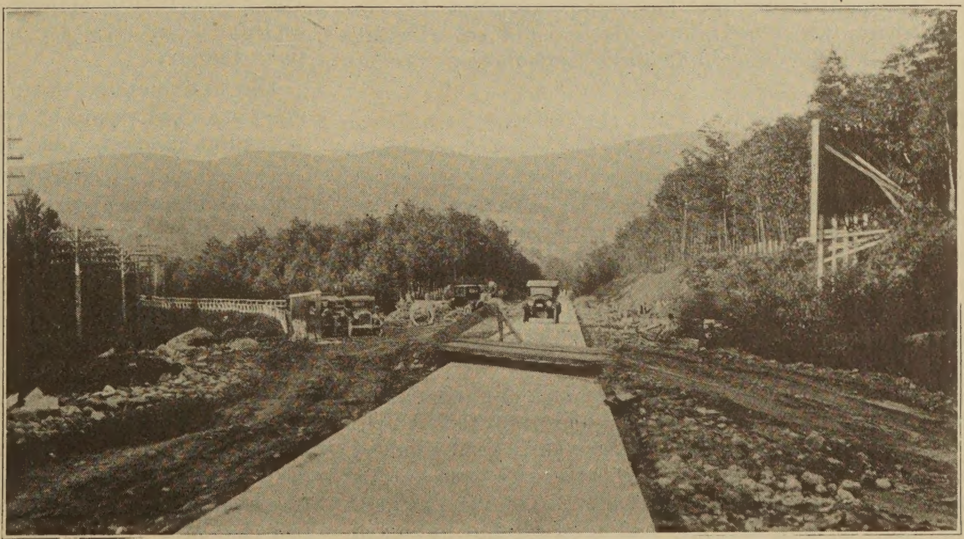
Preliminary grading for the new pavement was done during the winter of 1927 and 1928 and the subgrade was allowed to settle through the winter and spring months. Heavy rains through the spring and summer months assisted in getting the subgrade down to final settlement. This was important inasmuch as there are stretches of fill, in places 20 or more feet high. These fills alternate with cuts, some more than 20 ft. deep. A 12-in. gravel subgrade was laid on all cut sections. Rubble tile drains were run under all ditches in cuts.

Pavement Placed Half-at-a-Time

The pavement follows standard Connecticut specifications calling for a uniform thickness of 8 in. The pavement is 20 ft. wide divided down the center by a butt joint. This permitted laying the slab in two 10-ft. sections—a decided advantage in getting materials to the mixer. The longitudinal joint is filled with ¼-in. precast joint filler and has no dowels across the joint.

Each slab is divided into sections by transverse joints for expansion spaced 60 ft. apart. These expansion joints are filled with 1½-in. precast joint filler. The expansion joints were installed with a steel capped template cut to the crown of the road or a true circle with a 1½-in. drop in 10 ft.

Bridges were put across the pavement where existing roads intersected the new slab

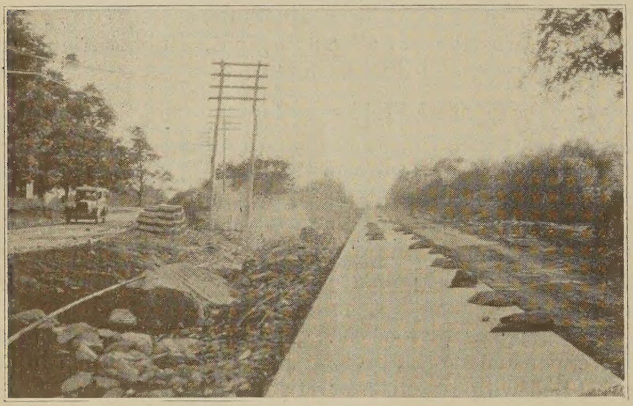


All the slabs are reinforced with marginal bars, but no mesh or bars were placed in the center of the slabs. At all corners a 4-ft. bar is run diagonally into the center of the slab to give additional corner strength.

Because of the location of the job, all materials were batched at the contractor's quarry about 12 miles from the mountain. The sand and cement were shipped to the quarry where the contractor had set up a batching plant. Proportions were made at the quarry and trucks loaded with complete batches hauled materials to the job. The cement was left in the bags which were placed on top of the mixed aggregates. Keeping the cement in the bags eliminated losses from wind during the haul. This arrangement also eliminated the cost of one man and permitted the inspector at the mixer to check the amount of cement per batch.

Concrete Control

The mix used was 1:2:3½ and all materials were turned a full 1¼ minutes. Two per cent of calcium chloride was added to the batch throughout the job. The contractor, to meet state specifications, installed a water measuring device on the mixer and water was kept between 4 and 5 gallons to each sack of cement. The variation was due to variation of moisture in the sand and to varying conditions of the subgrade. In this connection it might be stated that during placing, heavy rains saturated the subgrade, making excess water in some of the mixes. This difficulty was controlled through reduction of water in the mix. Throughout the job the slump averaged 1¼ in., a consistency which permitted placing and yet overcame some of the finishing difficulties encountered because of the grade.



Half-at-a-time construction permitted the contractor to get his materials to the mixer with the least difficulty

During the placing of the first slab the batch trucks ran on the subgrade and because of the rains these trucks caused some shaking in the subgrade which in turn caused movement in the green concrete. This movement was noticed for both solid and pneumatic tired trucks. The difficulty was overcome by routing the batch trucks to the top of the hill and backing them down to the mixer which worked up hill. Additional precautions were taken by retarding finishing fifteen to twenty minutes after the concrete had been screeded off.

Careful control was maintained over the aggregates. Coarse aggregate consisted of crushed trap rock with a maximum size of 2½ inches. Larger sizes predominated, resulting in a harsh mix. Fine aggregate was washed Connecticut sand running noticeably to coarse particles.

An Ord finishing machine was used on the pavement. The machine was followed by a screeding and then final finishing. During the first part of the job a wood belt was used but this proved impractical. A wood float was substituted and proved easier to operate on the fills and cuts. The belting was followed by a brooming, running straight across the slab. In the first few hundred feet this scoring was done diagonally across the slab, but the plan was abandoned.

As soon as the surface would stand it, the concrete was covered with burlap which was kept constantly wetted for 30 hours. After 30 hours the burlap was removed and no further curing was done. Core tests made of pavements finished and cured under this method and having been under traffic for more than one year show no signs of surface scale or wear.

Beam Tests

During all placing operations, beams were cast and cured beside the pavement under identical conditions with the slab. These beams were cast morning and night. The beams were broken in the state testing laboratory and the road opened to traffic when the beams showed a modulus of rupture of 500 pounds. The concrete showed this strength at average age of 2½ days. It might be noted that this beam testing is now a part of Connecticut practice. The state testing laboratory maintains a fleet of trucks which run between the laboratory and the paving jobs twice a day and bring in beams about two to three days old. The beams are broken and results reported back to the engineer in charge of the job.

Laying concrete began on June 11th and 900 feet of slab were laid the first day. This was followed by runs of 960 feet, 840 feet and 843 feet. The first half of the job was laid in 12 days. L. Suzio Construction Company, of Meridan, Connecticut, was the contractor for the cut, fill and slab. D. C. Loewe, of Winsted, was the division engineer in charge of the work.

Rising Construction Costs Laid to Higher Prices of Basic Materials

Construction costs have risen to the highest plane they have occupied at any time during the past thirty months, according to statistics just compiled by the Associated General Contractors of America. October was the third successive month to witness a rise in the cost average. The record for the elapsed portion of 1928 shows but one decline. Four rises are indicated as having taken place since January.

The first increase during this year occurred last June, breaking a succession of decreases that had been registered at regular intervals since mid-summer of 1927.

The average of construction costs now is slightly more than double the average recorded in 1913. The average for the first ten months of 1928 is slightly below the figure registered for the corresponding period of last year, a low-cost era during the opening months of the current year having served to offset the effect which recent rises have had upon the ten-month average.

The increase noted in October is attributed to higher prices commanded by basic construction materials during that month, the third in succession to witness an increase.

The wage situation continued to give every indication of a stabilized condition, presenting an average showing no change from that held by the preceding month. Only two changes in the wage average have occurred this year, a slight decrease in June and a counter-balancing increase asserting itself in September.

Painless Bookkeeping For Products Plants

The Fourth Article of a Series on a Simplified Method of Keeping Products Plant Records

By F. W. SCHNOEBELEN

Part IV—Opening the Books

In the December issue, Mr. Schnoebelen explained the fundamental principles of bookkeeping upon which the entire process rests. This was done for the benefit of those who have not had a great deal of experience in such work, but who are expecting to install a record-keeping system. The article explained the law of debits and credits, defined the various terms used in bookkeeping and presented a complete posting chart of much value to the beginner.

The present installment begins the application of these principles to the everyday work of keeping the records for a concrete products business. This article will show how the books are opened, what information is needed to begin, and how it is tabulated. With these things established, future articles will follow through with the actual operations necessary as the business gets under way.

WE are now ready to make a study of better bookkeeping methods for concrete products manufacturers. We will begin this task by presenting a month's business as it would occur in actual practice. This will comprise the opening and the closing of the books and the journalizing of all transactions. Of course, in doing this, we will not take transactions that are identical, but will make all entries in the books of original entry by group and by character as much as possible. This procedure will make the method more easily understood. All data is to be assumed, that is, it will not actually show the cost of any plant in particular, but will follow the lines of the average concrete products manufacturer.

A business, today, is operated either by individuals, partnerships or corporations. The distinction and the merits derived from each will not be discussed here. In our model method, we will presume that the business is a corporation. It is further assumed that A, B, C, and X wish to engage in the manufacture of concrete products and they take over the assets and the liabilities of the Standard Block Corporation. The net worth of this corporation is $40,000. The stock is all preferred and is to be shared equally among them. The corporation will engage a manager and a clerk, besides the factory foreman to operate the business. It is further agreed that 6 per cent interest will be paid on all the preferred stock, to be set up monthly, before any profit is to be divided in the form of dividends.

The assets and the liabilities of the corporation are as follows:

Cash in Bank	$ 1,000.00	
Accounts Receivable	8,000.00	
Inventories	4,400.00	
Stocks	3,000.00	
Real Estate and Buildings	22,000.00	
Equipment	12,480.00	
Good Will	5,000.00	
Total Assets		$55,880.00
Accounts Payable	$ 2,000.00	
Notes Payable	5,000.00	
Bonds Payable	8,880.00	
Total Liabilities		$15,880.00
The Net Worth		$40,000.00

Opening the Books

As it has been previously stated, the net worth or capital stock is the total amount of the assets less the liabilities. We are now prepared to open up our set of books. Our first entry is made in the General Journal, one of the books of original entry. The General Journal has a space for explanation and two columns, one for debits and one for credits as illustrated. This book will contain only those transactions which cannot be recorded in the Cash Book, Accounts Payable, Disbursement Record or the Sales Register with clearness. Our opening entry then will be made as shown on Exhibit D.1:

EXHIBIT D.1 Page 30

GENERAL LEDGER

January 1, 1929

Date	Name of Account and Explanation	Debits	Credits
Jan. 1, 1929	National Bank (deposits)	$ 1,000.00	
	Accounts Receivable (Ledger A)	8,000.00	
	Finished Goods (Inventory Book)	4,000.00	
	Raw Materials (Inventory Book)	400.00	
	Stock (Investment)	3,000.00	
	Real Estate (Factory)	10,000.00	
	Buildings (Factory)	12,000.00	
	Equipment (Factory)	9,000.00	
	Equipment (Office)	480.00	
	Automobiles (Truck and Sales)	3,000.00	
	Good Will	5,000.00	
	Accounts Payable (Ledger B)		$ 2,000.00
	Notes Payable (Bank Loan)		5,000.00
	Bonds Payable		8,880.00
	Capital Stock—A		10,000.00
	Capital Stock—B		10,000.00
	Capital Stock—C		10,000.00
	Capital Stock—X		10,000.00

(The opening entry of the Standard Block Corporation)

The next step is to post from the General Journal. Each amount in the first column is posted to the debit side of the General Ledger account on the same line with it; each amount in the second column to the credit side of General Ledger Account on the same line with it. The amounts are posted in the order in which the transactions are recorded. The page in General Journal and the letters G. J. (General Journal) are entered in the folio column in the ledger for reference. When an amount has been posted to the ledger from the journal, a check mark is placed preceding the amount in the journal to indicate that the amount is posted.

Books Balanced

If all our entries and postings are correct our books are then said to be in balance, i. e., the sum of the assets is equal to the sum of the liabilities plus the capital. To show that the books are in balance, it is necessary to draw up a balance sheet. Our balance sheet would then be as illustrated in Exhibit D.2. Balance sheets are usually made each month, and are kept as a permanent record. As mentioned before, the balance sheet reflects the financial condition of the business and is required by banks in making loans.

Purpose of Balance Sheet

Exhibit D.2 is the balance sheet of the corporation at the beginning of the business, and its sole purpose is to show the corporation's net worth. At the end of the month we will again draw up a balance sheet to see what changes occurred in the financial history of the corporation during that period. We want to know if there was a decrease or an increase in the net worth or whether the stability of the corporation has changed. This second balance sheet made at the end of the month, will be given in a later issue and is to be compared with Exhibit D.2.

Relation of Assets to Liabilities

From the balance sheet we determine the working capital of the business, which is the excess of its current assets over its current liabilities. The ratio of the current assets to the current liabilities is one indication of the probable ability of the corporation to pay its current debts, and is for that reason an indication of its solvency.

EXHIBIT D.2

The Standard Block Corporation of America

Balance Sheet, January 1, 1929

		Assets	
Current Assets			
Cash in Bank		$ 1,000.00	
Accounts Receivable		8,000.00	
Inventories:			
Finished Goods	$4,000.00		
Raw Materials	400.00		
Raw Materials	400.00	4,400.00	$13,400.00
Permanent Investment			
Stock (Cement Tile Co.)			3,000.00
Fixed Assets			
Real Estate		$10,000.00	
Buildings		12,000.00	
Equipment:			
Factory	$9,000.00		
Automobiles	3,000.00		
Office	480.00	12,480.00	
Good Will		5,000.00	39,480.00
			$55,880.00
		Liabilities	
Current Liabilities			
Accounts Payable		$ 2,000.00	
Notes Payable		5,000.00	$ 7,000.00
Fixed Liabilities			
Bonds Payable			8,880.00
Capital			
Capital Stock			40,000.00
			$55,880.00

It is usually considered that a business is not in a good financial condition unless its current assets are at least twice the amount of its current liabilities. This cannot be considered an invariable rule because of varying conditions in different concrete products manufacturers' businesses.

By studying Exhibit D.2, you will note that the ratio of the current assets to the current liabilities is two to one, indicating that the corporation is in a fairly healthy condition.

(In the next issue we will deal with Accounts Payable and Disbursement Record, one of the books of original entry.)

Plan Products Program of Real Value to Wisconsin Men

The Plankinton Hotel at Milwaukee, Wisconsin, will be the scene of another of the well known meetings of the Wisconsin Concrete Products Association on Thursday and Friday, January 10th and 11th. This gathering will be the seventh of its kind.

"Putting Promotion in Motion" is the title of a discussion of manufacturing and promotional methods in widespread use which will be presented by W. D. M. Allan and Robert Smythe of the Cement Products Bureau of the Portland Cement Association.

The Cast Stone Manufacturers of Wisconsin are scheduled to meet later in the day.

On the following day, the problems of the manufacture and sale of concrete products will be touched on in a series of ten-minute papers. "What of the Small Factory?" will be presented by W. G. Rathke, "Some New Ideas on an Old Subject," by Arthur W. Grube, and "From the Bottom to the Top" by Wm. H. Devos. Arthur Sorenson will talk about "A Square Block for a Round Hole."

The subject will be carried over into the afternoon's sessions, when the following will be presented; "Trimming Our Sales, by A. E. Broker, "Putting Over Something New" by C. O. Gochnauer; "Getting the Most with What You Have" by Fred C. Simmonds, and "Increasing the Family," by L. E. Schwalbe.

New Books

About Sand and Gravel

"Representative Specifications for Different Uses of Sand and Gravel." Published by the National Sand and Gravel Association, Inc., Washington, D. C.

This bulletin is the third of a series to be prepared by the engineering and research division of this organization. In it representative specifications for sand and gravel for different uses have been summarized. Their compilation was effected from a number of sources and it is intended to point out with them the best generally accepted practices in the different fields.

The following are the subjects of some of the titles of chapters, each dealt with in the customary clear and easily read manner: specifications for concrete sand, and for gravel, sand for use in building work, and sand and gravel for miscellaneous uses.

EDITORIAL

A New Year Ahead!

NOW, at the beginning of a new year, we not only review the activities of the year just passed, but what is more important, we look forward in an effort to discern what the coming year will bring. Backward glances are of value only as they point the way to the future.

For all of us in the concrete industry, regardless of the particular branch in which we specialize, the new year holds much. The momentum gathered last year and the years before will lend us a favorable start and our own constructive efforts will make 1929 a year of new and greater accomplishment than any that has gone before.

With this vision of accomplishment in mind, all of us of the "Concrete" staff wish that the new year will prove particularly satisfactory to each of our readers as they work to translate their ambitions into concrete realities through the coming months.

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A High Early Strength Specification

THERE is much difference of opinion among engineers and contractors on the subject of high early strength concrete and high early strength cements. It is natural that this should be so in view of the wide diversity of possible choices for obtaining high early strength concrete that is before the user.

He may use the "standard" portland cements that he is familiar with and, by means of richer mixes, longer mixing time, etc., obtain a concrete that will fill his needs when speed is an important item. Or he may try some one or more of the various "special" cements that are on the market in an effort to secure early high strengths. In the first case he may be reasonably certain that the quality of the concrete secured will be satisfactory from the standpoint of long time tests, as well as from the standpoint of early strength. In the second case he may secure concrete that will be equally satisfactory or he may run into considerable difficulty. When he enters that uncharted territory of "high early strength," he has no means of assuring himself by accepted standards that the results will be as he anticipates.

That high early strength concrete, whether secured through special manipulation or through special cements, has come to stay is assured. Users have had it called to their attention in advertisements, in articles, in papers read before the technical societies and in other ways. It has entered into their scheme of things and the advantages secured from it are very real and have been shown to justify extra expense or extra effort.

A recent survey of the opinions of highway engineers on this subject illustrates these viewpoints and indicates the attitude of at least one branch of the industry. Opinions expressed by users in other branches parallel those of the highway engineers closely. Probably because they have been getting accustomed to think in terms of higher strengths, it is not surprising that their minds are again turning to a revision of the "standard" specifications for cement and that in some cases they have even written their own specifications requiring higher strengths. Is it not possible that this, in a considerable measure at least, is occasioned by the lack of another specification that covers the territory beyond the present "standard" specification?

The present standard quality of cement may always be sufficiently high for the largest portion of concrete placed. Would it not, therefore, be unwise to impose additional restrictions that would apply to all cement used? Would it not be more to the point to formulate another specification covering cements having those extra qualities that the user requires for special conditions? And would not the establishment of such an additional specification, based on what is already known of such cements, protect the user and relieve him of the responsibility of choosing between a number of conflicting claims? The user who desired those extra qualities could then choose more confidently how he would secure them than he can now. If he wants higher early strengths than the "standard" cements will give under standard conditions, he can have them at the price of richer mixes, etc., or at the additional cost of special cements, tested under the proposed new specification.

Discussion of this question is invited.

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Concrete Street Paving Practices

PROGRESS in the use of quality controlled concrete characterized every branch of the concrete industry during the past year. This was, in fact, the outstanding development of the year. In the concrete street paving industry, also, there has been some progress in the adoption of better construction methods, but it is here that a definite need for further progress exists.

For some reason, probably intensified by political interference, many specifications for concrete street paving do not include most of the requirements that have proved their value over a period of years under similar field conditions. Highway engineers have included these provisions in their specifications and, as a result, the quality of concrete placed in country highways is as a whole superior to that in city streets. The same results can also be obtained in street pavement construction.

A.C.I. Convention Centers on Durability

Papers at Initial Session Will Deal with Durability—Two Sessions Concurrent—Interesting Papers Scheduled for Cast Stone Meeting

DURABILITY of concrete—from the reports of committee investigations to a condition survey of concrete placed more than twenty years ago—will lead the topics to be discussed at the American Concrete Institute convention, meeting at the Book-Cadillac Hotel, February 12th to 14th, both inclusive, at Detroit, Michigan.

Durability is scheduled to be the subject of the opening session, when a condition survey of concrete structures, of which the work of Committee E-6, Destructive Agents and Protective Treatments, is the nucleus, will be presented.

Three brief papers, as follows, will form the balance of this session: "Lessons Taught by Concrete Structures in Service," by R. B. Young; "Thomson Dam and Reservoir," by H. C. Ash, with discussion by M. B. Lagaard, and a paper on the early concrete work of the Erie railroad by L. W. Walter.

The evening session will open with a paper by M. Freyssinet on the long span arch bridge near Brest, France, followed by another by Messrs. Douglas and Nelles, of the Detroit Edison Company on "Economy of Quality in Concrete." Two other papers scheduled for this session are those by L. G. Lenhardt, of the Detroit Board of Water Supply, telling how desired quality was obtained in Detroit water tunnel work, and by John Bischoff of the Detroit Department of Buildings and Safety Engineering, on the systematic monthly check of quality of concrete poured by Detroit contractors and how publication has raised the average.

Wednesday morning has been left free on the program for the making of a tour to a place of general interest by everyone who wishes to go.

The afternoon of Wednesday, February 13th, will again see concretors in session, either at that gathering devoted to research or that on concrete stone and ornamental concrete, since these are concurrent. The program of the former includes a paper by Prof. R. E. Robb, entitled "Moisture Content of Sand," another by Prof. Raymond E. Davis, on "Volume Changes in Concrete," and one by Herbert J. Gilkey on the subject of "Water Tables and Curves for Use in Designing and Estimating Concrete Mixtures." Others are, "High Early Strength Concrete" by E. E. Bauer of the Department of Civil Engineering of the University of Illinois, "Design of Reinforced Concrete Slabs" by Prof. Joseph A. Wise. T. C. Powers will present a paper entitled, "Describing Studies of Concrete Made at Bull Run Dam," followed by another to be read by Hardy Cross, professor of structural engineering, University of Illinois, entitled "Continuity as a Factor in Reinforced Concrete Design."

Concrete Stone and Ornamental Concrete

The concrete stone conclave, concurrent with the above, on research, is to begin with the report of Committee P-3 entitled "Specifications for Cast Stone," followed by a paper prepared by Fred Weigel of the Southern Cement Products Company, Knoxville, Tennessee, on "Testing Concrete for Absorption." Raymond Wilson of the Portland Cement Association testing laboratory will then present another entitled "Effect of Drying Temperatures on Strength and Absorption of Cement Mortar." J. Tucker Jr., and C. W. Walker of the U. S. Bureau of Standards will co-operate in the presentation of "A Study of Commercial Cast Stone." At this session also W. D. M. Allan of the Portland Cement Association is scheduled to talk on "Fundamentals of Cast Stone." He is scheduled to review practices in need of correction.

Specifications

At the Wednesday evening sessions—of which there are also two, concurrent—the development of specifications for reinforced concrete and standard concrete building units will be the subjects brought up for discussion. W. S. MacKenzie and George Eyrick of Smith, Hinchman and Grylls, Detroit architects, will bring before the assembly a paper entitled, "The Development of Specifications for Reinforced Concrete." L. E. Williams, will discuss confusion existing in aggregate specification at the present time, and P. J. Freeman will talk on "Specifications for Centrally Mixed Concrete." S. C. Hollister is scheduled to present a paper having to do with specifications on small jobs. At this session also two reports will be brought up. They are as follows: "Revised Purchase Specifications for Aggregates" by Committee E-5, and the "Joint Code" by Committee E-1.

The building unit session that concurs with the above will deal with the work of Committees P-1 and P-6. One paper, by R. A. Foley of Detroit, on "The Effect of Curing Temperatures," will be presented at this time.

Durability

The theme of the two Thursday sessions is "Standards of Performance of Concrete for Various Uses," which includes brief papers on the characteristics of concrete for a variety of kinds of structures and conditions of use and exposure. The effect of sea water will be covered in a paper by H. E. Squire, assistant harbor engineer, State Board of Harbor Commissioners, San Francisco; alkali soils, by C. J. MacKenzie, dean of engineering, University of Saskatchewan, Saskatoon; roads, F. H. Jackson, of the U. S. Bureau of Public Roads, and houses, S. C. Hollister, consulting engineer, Philadelphia. Other subjects and the men who will talk about them are, reinforced concrete buildings, Nelson L. Doe, of the Turner Construction Co., New York City; fire resistance, N. D. Mitchell, Chairman A. C. I. Committee E-4; stucco, W. D. M. Allan; building units, A. C. I. Committee P-1, Standard Concrete Building Units; and floors, John G. Ahlers, Barney-Ahlers Construction Corporation, New York City.

And then, but for the twenty-fifth annual dinner, the concretor is ready to take his leave for home and make inspired concrete.

A word about the dinner. Following President Boyer's address, presentation of the Wason Medal for Most Meritorious Paper of 1928 Convention will be made, as will also the Turner Medal for Outstanding Achievement in or Service to the Field of Concrete. The advance and incomplete program from which this outline is taken also assures the dinner will include an address by a speaker with a subject of real interest.

Economical Form System for Joisted Floor in Bank Building

How Contractor Solved Form Problem And Reduced Costs By Detailing and Shop Fabrication.

By A. F. KLEIN
Vice President
and GEO. A. ZAK
Engineer, R. C. Wieboldt Co., General Contractors, Chicago, Illinois

THE modern trend of the construction industry is toward a greater use of labor-saving machinery and to the elimination of hit-or-miss make and try work in the field. This trend, which brings into play a more careful system of job management leads to greater economy of effort, greater accuracy of results, and a lessened interference between trades, thus bringing added profit, lower unit costs, and lessened extra expenditures, is well typified by the methods used by the R. C. Wieboldt Co. in doing the form work involved in its concrete jobs.

Designing Forms

When a job is to be organized, a careful study is first made of the relative economy of several different form schemes, and with this study as a basis, the best form method for the particular job is then selected. This gives valuable bidding information, and provides data for use on planning progress. When the contract is secured, the engineering department works up detailed drawings of the forms needed, with complete directions for each cut to be made, and the resulting working drawings and beams, slab and column schedules, are sent to the shop, with each piece marked just as in steel work. The shop then produces the form units called for, just as a millwork shop would furnish millwork items, and delivers the completed pieces to the job as needed, ready for erection. In the case of a really large job, shop equipment might be set up on the lot in a convenient location, and thus relieve the permanent shop from work that might interfere with the production of the usual run of business. Then when the completed form units are received they can be quickly erected with consecutive 2-man crews with no cutting for the first use, and with but little cutting for use on the upper floors. The work of detailing in the office can often reveal a possible reduction in the estimated number of sets of forms to be needed.

How to handle form work most economically and efficiently is a problem that faces every contractor. What scheme or design should be selected? Which type is most economical from every standpoint—amount of lumber required, ease of erection and stripping, labor cost, lumber available, speed of erection, etc? Is it more economical to fabricate the forms on the job or in a form shop at the contractor's yard?

These questions are answered in this article in which a complete analysis of the form problem on a typical contract is presented. The article contains many practical suggestions for all contractors.

An Exact Design

The definite advantage secured from this policy of designing the forms in the office and making them up in the shop is that the forms may be designed to safely carry the loads in accordance with accepted working stresses, and yet the lumber used may be held down to the minimum. In the older method of letting the carpenters work out their own forms from the lumber furnished by the dealer, the contractor will experience under or over design, a great waste of lumber and labor due to the hit-or-miss way in which the men will work and the constant remaking due to miscutting at the bench, and valuable space will be used by the carpenters that is badly needed by other trades. Too, the ever-present chance of collapse of formwork is avoided, since there cannot arise any situation where the forms cannot carry the loads, as they are designed by a competent engineer from universally accepted safe working stress tables. Another advantage is that the workmen do not have to be familiar with the general plans for the building as with the ordinary policy, because the carpenters making the forms merely have to follow the working drawings and schedules, and the erectors follow the erection drawings, setting the pieces by number, just as in the two steps of steel fabrication and erection. In this way mistakes due to lack of foresight and to lack of provision for other trades are eliminated. The carpenter foreman no longer needs to worry about detailing, and can give full attention to supervision.

Making the Decision

At the beginning, the first step taken is a conference between the engineer, the superintendent, and the foremen to decide upon which general form method will be used. Various systems are considered, and costs compiled, and finally a tentative system is decided upon. This is next put up to a member of the firm for approval. After the general scheme is approved, the engineering department proceeds with the detailing of each timber, and this work calls for shop and general assembly drawings, just as in structural steel work.

Foundation pier forms are made up in panels giving column numbers, marked E, N, etc. Column forms are made up in diagonal halves, with a center board to be ripped down when the panels are to be used on the upper floors where the columns are of a smaller size.

It is of interest to note that the usual details call for 4 by 4 lumber where it is usual to use the 2 by 4 size, since the 4 inch material may be used more times, and 2 inch sheathing is used in place of the usual 1 inch sheathing, again for the sake of greater reuse. One inch stuff

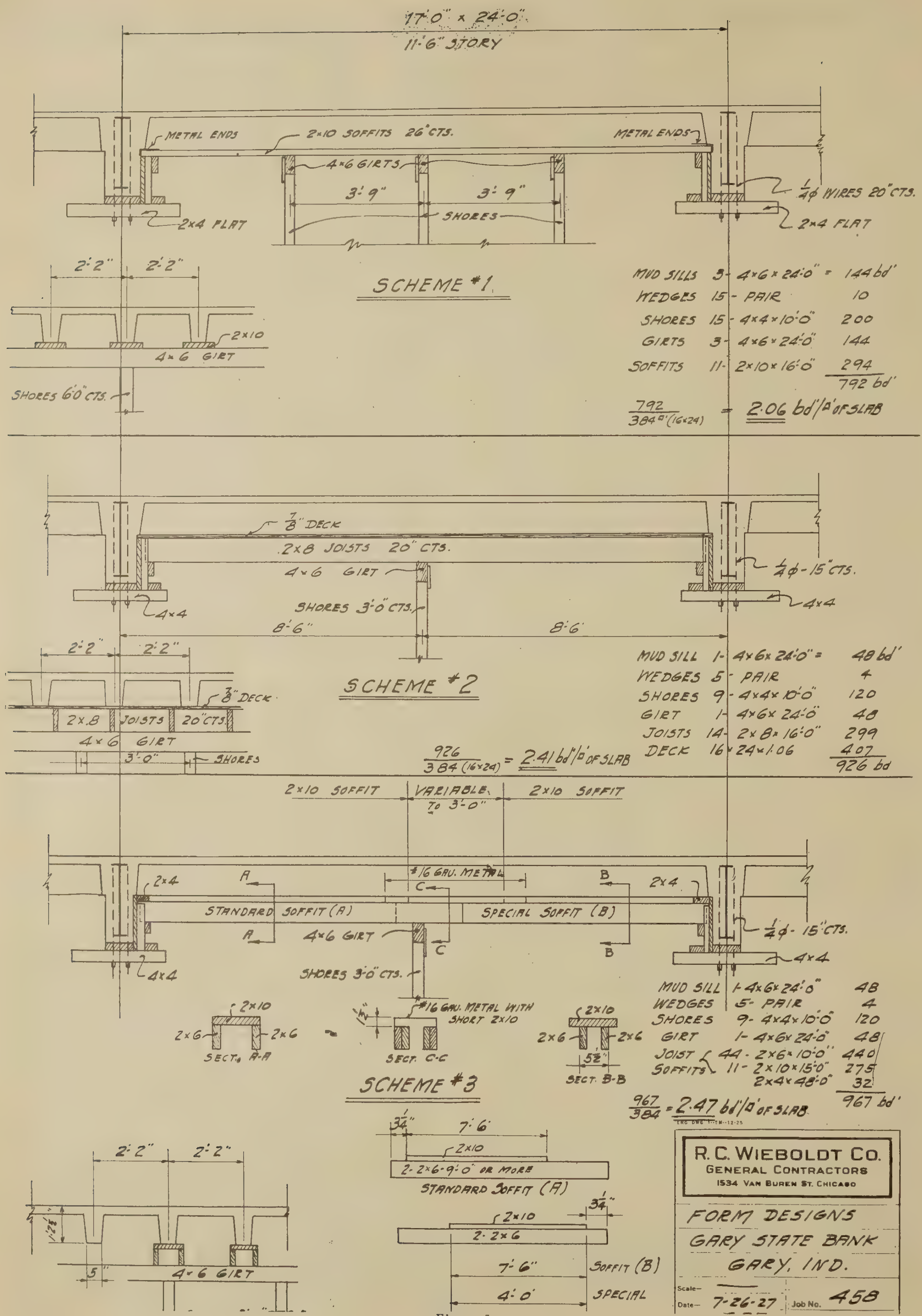

17'0" × 24'0"
11'6" STORY
METAL ENDS
2×10 SOFFITS 26" CTS.
METAL ENDS
4×6 GIRTS
3'9"
3'9"
SHORES
1/4 ϕ WIRES 20" CTS.
2×4 FLAT
2×4 FLAT
2'2"
2'2"
2×10
4×6 GIRT
SHORES 6'0" CTS.
SCHEME #1
MUD SILLS 3- 4×6×24'0" = 144 bd'
WEDGES 15 - PAIR 10
SHORES 15 - 4×4×10'0" 200
GIRTS 3- 4×6×24'0" 144
SOFFITS 11- 2×10×16'0" 294
792 bd'
792 / 384□'(16×24) = 2.06 bd'/□' OF SLAB
7/8" DECK
2×8 JOISTS 20" CTS.
4×6 GIRT
1/4 ϕ - 15" CTS.
4×4
4×4
SHORES 3'0" CTS.
8'6"
8'6
2'2"
2'2"
7/8" DECK
2×8 JOISTS 20" CTS.
4×6 GIRT
3'0"
SHORES
SCHEME #2
MUD SILL 1- 4×6×24'0" = 48 bd'
WEDGES 5 - PAIR 4
SHORES 9 - 4×4×10'0" 120
GIRT 1- 4×6×24'0" 48
JOISTS 14- 2×8×16'0" 299
DECK 16×24×1.06 407
926 bd
926 / 384 (16×24) = 2.41 bd'/□' OF SLAB
2×10 SOFFIT
VARIABLE TO 3'0"
2×10 SOFFIT
#16 GAU. METAL
2×4
A
C
B
2×4
STANDARD SOFFIT (A)
SPECIAL SOFFIT (B)
A
4×6 GIRT
C
B
1/4 ϕ - 15" CTS.
4×4
4×4
SHORES 3'0" CTS.
2×10
2×6
2×6
SECT. A-A
#16 GAU. METAL WITH SHORT 2×10
SECT. C-C
2×10
2×6
2×6
5 1/2"
SECT. B-B
SCHEME #3
MUD SILL 1- 4×6×24'0" 48
WEDGES 5- PAIR 4
SHORES 9- 4×4×10'0" 120
GIRT 1- 4×6×24'0" 48
JOIST 44 - 2×6×10'0" 440
SOFFITS 11 - 2×10×15'0" 275
2×4×48'0" 32
967 bd'
967 / 384 = 2.47 bd'/□' OF SLAB
3/4"
7'6"
2×10
2-2×6-9'0" OR MORE
STANDARD SOFFIT (A)
3/4"
2×10
2-2×6
7'6"
SOFFIT (B)
4'0"
SPECIAL
2'2"
2'2"
1'2 1/2"
5"
4×6 GIRT
R. C. WIEBOLDT CO.
GENERAL CONTRACTORS
1534 VAN BUREN ST. CHICAGO
FORM DESIGNS
GARY STATE BANK
GARY, IND.
Scale—
Date— 7-26-27
Job No. 458

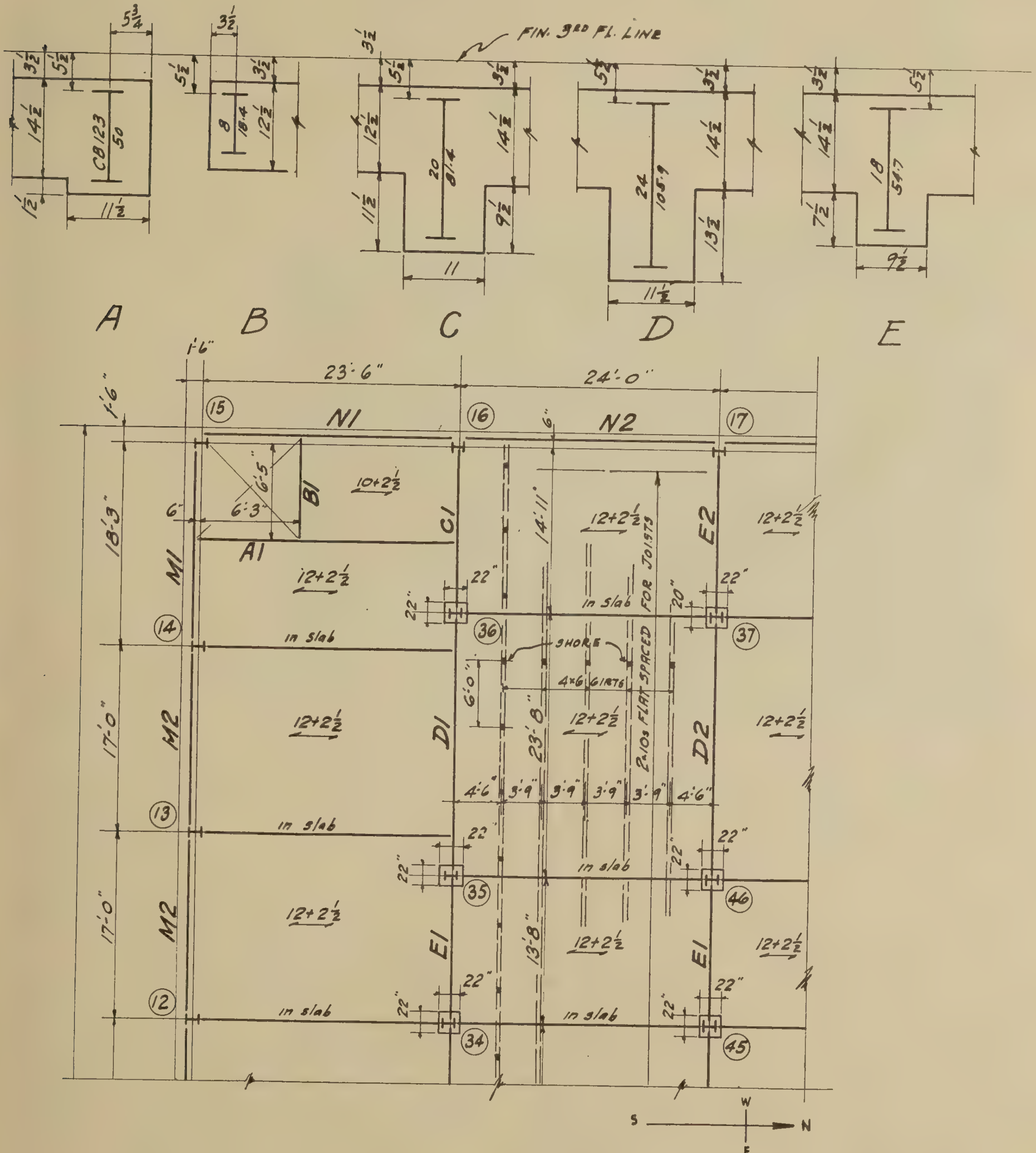
Figure 1

has an average loss of 80 per cent, while 2 inch lumber can be reused many times.

Patented shores are often used for the sake of conserving lumber, and open centering is usually preferred to tight decking. Round sheet metal column forms are used in preference to wood column forms wherever possible. Use is made of the practical types of metal column clamps. The lumber for each job is figured on a rental basis, in order to encourage maximum reuse and the job is credited with all serviceable lumber returned.

Erection Procedure

The shop and erection drawings make provision for all inserts, rods, special materials, and expansion joints. In designing the forms, the engineers have made up design tables worked out to show safe sizes of timber for the various live-loads, and in these computations the usual working stresses for timber have been increased from 25 to 30 per cent to allow for greater economy with safety, considering that this is but temporary construction. In passing, it is interesting to note that on the erection



PART 3RD FLOOR FORM
ERECTION PLAN

Figure 2

SCHEDULE OF BEAM BOTTOMS

2" MATERIAL UNLESS OTHERWISE NOTED — MATERIALS FOR ONE BEAM BOTTOM ONLY

MARK OF BEAM	NO. OF BEAM BOTTOMS REQ	DIRECTION	℄ of Col., Beam, or Face of Wall		LENGTH OF BEAM BOTTOM			DIRECTION	WIDTH OF BEAM BOTTOM	2X4 CLEATS ~~CENTERS~~		¼φ WIRES			SPACING OF CLEATS & WIRES	
										NO.	LENGTH	NO.	SIZE A	SIZE B	1ST CLEAT OR WIRE	
A1	1	S		6 1/8"	23'-0 1/4"	5 5/8"		N	11 1/2"	14	24"	14	8 1/4	30	24"	7@36"
B1					No Bottom Required											
C1	1	E		11 1/8	13'-10 3/4"	1 1/8		W	11	8	30	8	7 3/8	42	20	7@20
D1	1	E		11 1/8	21'-9 3/4"	11 1/8		W	11 1/2	12	30	12	8 1/4	42	20	11@20
D2	1	E		11 1/8	21'-10 3/4"	10 1/8		W	11 1/2	12	30	12	8 1/4	42	20	11@20
E1	2	E		11 1/8	11'-9 3/4"	11 1/8		W	9 1/2	6	30	6	6 1/2	40	20	5@20
E2	1	E		10 1/8	13'-11 3/4"	1 1/8		W	9 1/2	7	30	7	6 1/2	40	21	6@21

Figure 3

of the forms, girts are run the long way of the building, and that the work of erection is done by a sequence of 2-man crews each performing one particular operation exclusively, and each crew following the preceding crew. In this way the forms are set in a continuous process, each crew highly skilled in its own operation through constant and exclusive repetition of the operation, and the highest efficiency is accordingly gained. In effect, this is an application of the Ford system of production to the construction of a modern building, as far as the form work is concerned.

Forms must be substantial and unyielding so that the finished concrete work will conform to the required dimensions and contours. They must be designed to carry not only the load over the floor construction but also a construction load of not less than 50 pounds per square foot. Wall and column forms must be able to resist a hydrostatic pressure of 145 pounds per cubic foot. Forms must be built tight enough to prevent loss of cement mortar which not only weakens the structure but is one cause of honey-combing, thereby necessitating additional expense in patching which at best is unsatisfactory in exposed work.

The cost of form work for the same type of floor construction varies and depends largely upon the scheme of construction adopted. A successful scheme must be simple to permit speedy erection and so detailed with clearances as to permit easy removal of forms. This is not only a

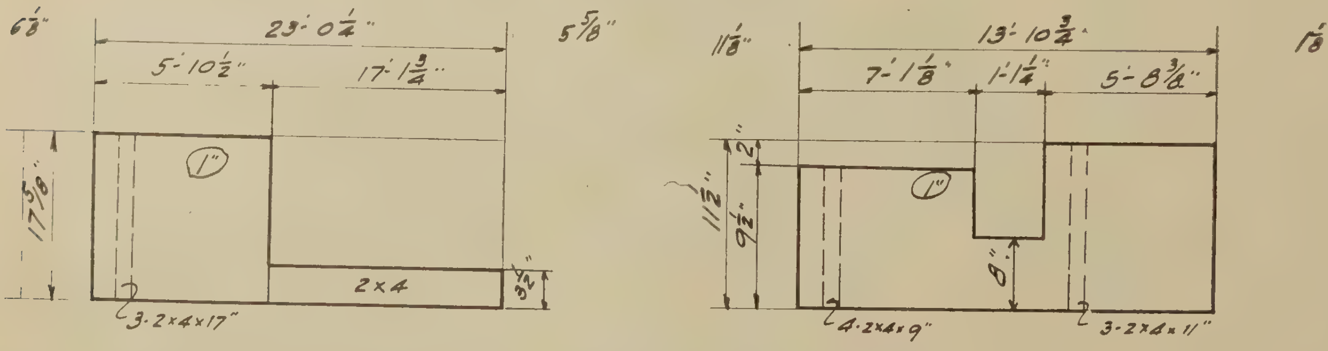
(Continued on page 46)

SCHEDULE OF BEAM SIDES.

1" MATERIAL UNLESS OTHERWISE NOTED — MATERIALS FOR ONE BEAM SIDE ONLY

MARK OF BEAM SIDE	NO OF BEAM SIDES REQ	DIRECTION	℄ of Col., Beam, or Face of Wall		LENGTH OF BEAM SIDE			DIRECTION	WIDTH OF BEAM SIDE	2x4 CLEATS 24" CENTERS		~~WIRES~~			REMARKS
										NO.	LENGTH	~~NO~~	~~SIZE A~~	~~SIZE B~~	
B1S	1	E		5 7/8"	5'-11"	6 1/8		W	14 1/8"	3	14"				
C1N	1	E		11 1/8	13-10 3/4	1 1/8		W	9 1/2	—	—				2" Material (2x10)
D1	2	E		11 1/8	21-9 3/4	11 1/8		W	13 1/2	11	13				
D2	2	E		11 1/8	21-10 3/4	10 1/8		W	13 1/2	11	13				
E1	4	E		11 1/8	11-9 3/4	11 1/8		W	7 1/2	—	—				2" material (2x8)
E2	2	E		10 1/8	13-11 3/4	1 1/8		W	7 1/2	—	—				" " "

Figure 4



MAKE 1- MARK A1W

MAKE 1- MARK C1S

Figure 5

What Is This Merchandising, Anyway?

Where Does It Begin and Where Does It Stop?

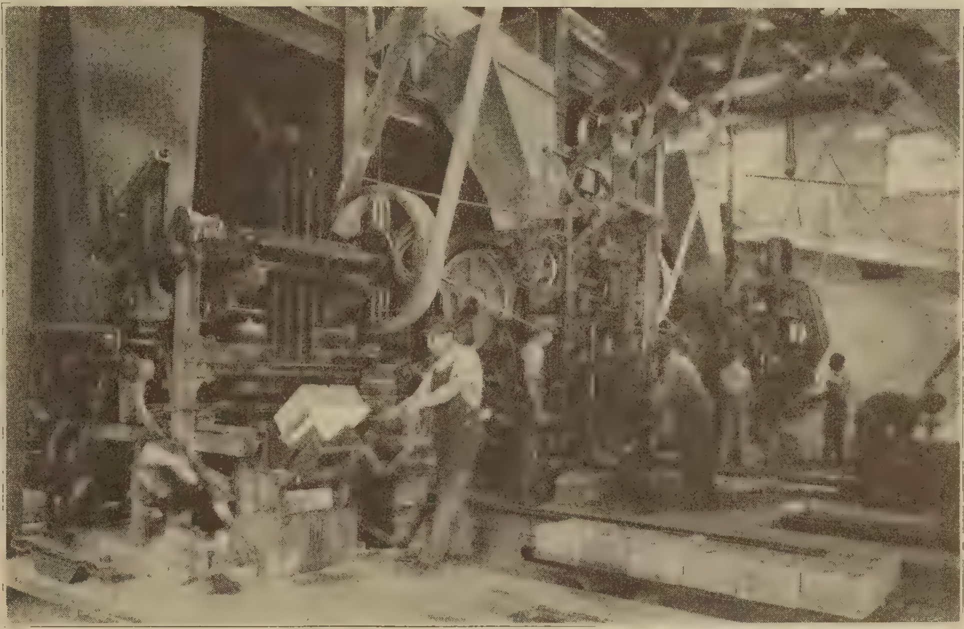
By "SPEC" COLLINS

ART DEVOS, Les Grube and the writer were discussing the program of the forthcoming convention of the Wisconsin Concrete Products Association. "I suppose," said Art, "that you fellows have cooked up a program with some merchandising stuff in it."

"It's all going to be merchandising," replied Les, looking at me out of the corner of his eye and eagerly waiting for Art's comment. The comment came—and led to Les' reply, and this article.

"Why," exploded Art, "aren't you going to have something about manufacturing or about specialties like this new roofing tile we've taken on?"

"We'll have that," said Les, "and more, too, but after all isn't that merchandising? You folks have made some pretty extensive changes in your plant during the past year so that you could make a better product and do it more economically. You've done a lot of experimenting with time of mix and amount of water and different proportions. You wouldn't have done it if you hadn't felt it was going to increase your profits and make selling just a bit easier. Then you've taken on a new specialty, roofing tile, to take up the slack in your block production, thus keeping your total production on a more stable basis. If that isn't all sound merchandising, I don't know what is."



A quality product means a salable product and successful manufacturers consider that merchandising starts in the plant

The Scope of Merchandising

Call it improved manufacturing methods, creating new markets, publicity, changes in product to meet popular demand, advertising, sales policy or what you like; I contend it's all merchandising. That's taking in a pretty broad field, but to me it is the answer to the question many concrete products manufacturers have been turning over in their minds, "What is this merchandising anyway? Where does it begin and where does it stop?"

Perhaps you think, as I used to, that merchandising begins when you step on the starter and drive out of the yard to make your first call. That's the Model T idea of merchandising. The Model A idea starts out in the shop long before you ever try to sell a block. First it will be necessary to make a good product. Quality means salability and is the foundation of any successful business venture. Then make a product that fits the market, that is, in size, appearance and accepted usage. Let's amplify on this a bit. As Les Grube remarked, the Wm. H. Devos company has spent a lot of money the past year changing equipment in its plant. Certain machinery was scrapped and replaced with equipment more modern and up to date. That, to my mind, was a first class piece of merchandising for it enabled them to make a better, more uniform product than they had been making before and at a lower production cost. This put them in a position to meet a stiff competitive market without too great a sacrifice in profit—one of the cardinal principles in good merchandising.

Now for a product that fits the market. If the masons in your market want a smooth textured unit you'll have a lot less sales resistance if you give it to them. Under ordinary circumstances that would raise production costs, but by an application of laboratory practice to shop operation it can be worked out with satisfaction as far as production costs and quality are concerned. Another good piece of merchandising that is going on in many shops is in lightening the weight of the unit. Though this usually calls for the scrapping of many pallets and the purchase of new core equipment those who have made the change seem to be finding it decidedly worth while. A thinner webbed, lighter weight block calls for better concrete, to be sure, but that doesn't necessarily mean more expense. It means better graded aggregate and more careful mixing. But then clean, well graded aggregate always was the cheapest in the long run and time spent in determining the proper grade of aggregates for thin webbed units is an investment that will return good interest. Masons seem to like the lighter weight units and the part the factory plays in the manufacture of this product makes selling easier.

A properly balanced stock pile is a definite aid to merchandising

Appearance an Aid to Selling

Then we have appearance. A good looking unit is invariably more easily sold than a poor one. A factory superintendent, even though he may not be the highest paid man on the pay roll can easily be the most expensive. He can allow machines to become fouled and dirty. He can be careless about his mixes, resulting in slumped and crooked block. The cost of repairing carelessly kept concrete machinery is a mighty large item that adds eventually, to the cost of each individual unit. Yet if repairs are made as they are needed it is surprising how this cost can be kept down. Crooked units or units with rough and uneven mortar beds never bring back customers. A salesman can spend weeks cultivating a customer and getting his business and a careless shop superintendent can drive him away in two hours with a job of poorly made block. I hope you get my point. The whole scheme of successful merchandising hinges on the product and the manner in which it is made.

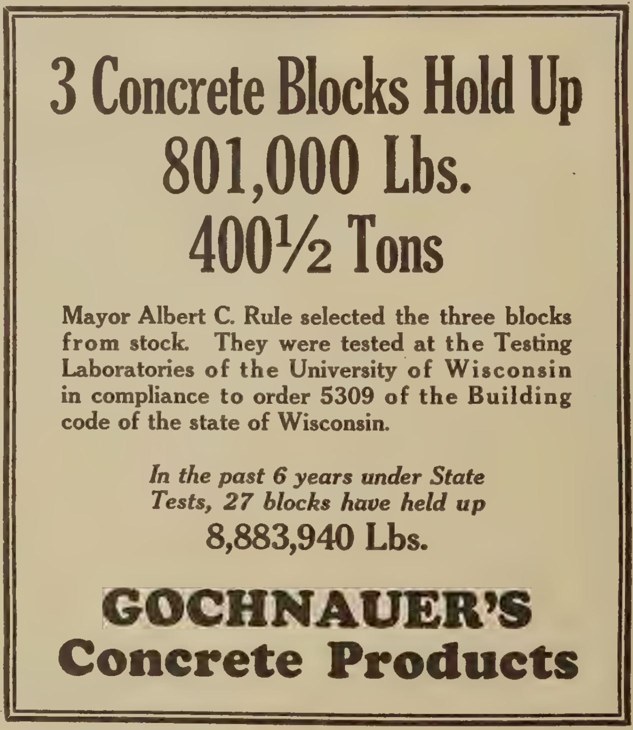
Then we have another factor that is making itself felt in the concrete products industry as well as in other industries far removed from it—that of color. What a riot of color we have nowadays. A black automobile is a novelty. Even our good old friend the kitchen sink and the accessories that go with it have blossomed forth in a regular riot of color. Les Schwalbe over at the EcOnomy Concrete Products Company led the latest onslaught on the color market in Milwaukee. He found that by using a certain combination of materials that he could make a concrete block that was almost as white as the driven snow. It was a good merchandising point that originated in the factory and he made instant use of it. At once there was a wild scramble among the other concrete products manufacturers to "lighten up" the color of their block. Color had arrived in the Milwaukee market and very definitely. It was a child of manufacturing that made an immense difference in selling.

A Specialty Helps

In the concrete products business there are certain seasons of the year that are necessarily dull. Overhead goes on during these dull seasons just the same. The manufacturer who anticipates these dull seasons and takes on some specialty to keep his plant moving on an even keel is performing a good piece of merchandising. Some manufacturers make roofing tile, some make manhole blocks and others burial vaults. Enough of a stock is usually built up during the dull season to carry through the rush season. That levels off the fixed overhead and reduces manufacturing costs on the whole business.

Good Advertising Like Concrete Road

And if you're doing all these things and doing them as they should be done they can be capitalized on in your advertising and your sales. That leads us to advertising, which has a very definite place in any plan of merchandising. There are many ways that advertising can be used to build good will for your product, but you yourself will have to decide the best method of spending your advertising dollar. You can throw your advertising appropriation around with no definite plan and have it get you nowhere, but if you have a carefully prearranged plan it is sure to do some good. Good advertising is like a concrete road—it makes it easier for you to get where you are going. But it should be a continuous stretch or it will lead you only half way, and then all the good is lost.



3 Concrete Blocks Hold Up
801,000 Lbs.
400½ Tons

Mayor Albert C. Rule selected the three blocks from stock. They were tested at the Testing Laboratories of the University of Wisconsin in compliance to order 5309 of the Building code of the state of Wisconsin.

In the past 6 years under State Tests, 27 blocks have held up
8,883,940 Lbs.

GOCHNAUER'S
Concrete Products

One of Cal Gochmaur's business producing advertisements

Intelligent Advertising

The best advertiser I know in the concrete products business is the Gochnauer Concrete Products Company of Appleton, Wisconsin. In the six years I've known the

Gochnauers I don't believe they've missed a week telling the people of Appleton about their products. They use newspaper space to do this. Appleton is a city of about thirty thousand so their newspaper space does not cost as much as it would in a large city daily. Except on special occasions they use small space—just a line or so of printed matter bringing out something interesting about their product or some particular job they are furnishing. In winter they tell the people they are operating so as to have a stock of well cured block available for spring business. In spring they remind people about the block they made last winter and tell them where they can see them being used. All the year 'round they tell how these block are made, what material is used, how it is graded, where it is purchased and why, how combined, how the blocks are tamped, how cured and delivered. Often they secure reprints of these advertisements from the newspaper and use them as direct mail pieces to supplement personal letters about their products and their use on some particular job. At least once a year they splurge a bit and use a half or quarter page of space to tell about the tests on their products. These tests are translated into terms that everyone can understand and are not merely given in the "pounds per square inch of gross area" language of the testing laboratory. In fact "as strong as Gochnauer's blocks" is almost a household expression around Appleton.

Job signs are an effective advertising medium

Why not an outdoor sign like this along the main highway into your city?

Advertising

But this newspaper space, as I have said before, is not the only advertising they do. Direct mail is used to quite an extent and job signs adorn every job. This other advertising all ties up to the newspaper campaign, however. This year Gochnauers started to make haydite block. The campaign they used to introduce this new material to their community is worthy of the best advertising agency in the country. First they had the material specified for a model home being built under the direction of the local newspaper. Then they made one of their occasional splurges in newspaper space and took a half page to tell the people about the new material. But the real merchandising came in the follow-up of this large advertisement. Each succeeding ad for a number of weeks later explained in detail the points brought out in a general way in the large ad. Inquiries were numerous—in fact, too numerous to suit the writer, who always looked forward to the annual pilgrimage to the north woods after muskies with the Gochnauers as one of the high spots of the year. There was no fishing trip this summer. The demand for block was too great.

Publicity

The tie-up with the model home resulted in a lot of mighty good publicity. Publicity—there's another phase of merchandising. Now just how does that differ from advertising? Well, I'd say that you generally have to pay for advertising, but publicity is a by-product that is either thrown in for good measure or given gratis intentionally or unintentionally. News stories that you don't have to pay for are considered as newspaper publicity. Or it may be talk that comes as a result of some advertising stunt or job. One block manufacturer I know tossed one of his blocks from the top of a three-story building that was being erected to the ground below. The block came through in good shape and he ran a small ad in his local paper telling what he had done and listing the witnesses. On the strength of this stunt and because the man and his product were well known in the community the newspaper ran a story telling about it. Far more people read the news story than the advertisement and although this happened several years ago his contractor friends still talk about it.

Pipe Stunt

A manufacturer of concrete pipe saw to it that several lengths of his pipe were on the lot when the circus came to town. Then he arranged with a photographer from one of the local daily papers to get a picture of the largest elephant from the circus standing on the pipe. Everyone was interested in the picture and the fact that the pipe would hold up an elephant meant more to them than all the laboratory test sheets the manufacturer had accumulated in a year's time. And it cost mighty little. Publicity is a valuable asset in merchandising and will often create more good will and favorable comment than a paid advertisement.

But after all, the things that have gone before lead up to the time when you switch on the ignition, step on the starter and start out after "it." We'll have to wait until next month for that.

(In the next article there'll be something about sales methods that different manufacturers have used to sell their products—and something about collections. Oh, yes, collections are a vital part of merchandising, for if you don't collect what good are the sales?)

Concrete Factory Built at Cost Estimated for Frame Construction

Contractor Co-operates with Owner in Changing Type

AMONG the somewhat smaller industries in Omaha is the Haskins Soap Company. For many years they have occupied an old building constructed of exterior brick bearing walls with small, infrequent windows. All columns, girders, beams and joists are of wood. New wings have been added from time to time, and the result is a poorly lighted, poorly ventilated building in which real economy in factory operation was out of the question.

Being confronted with the need for a new building, a draftsman for the soap company was instructed to make the designs. Using the plans for some of the additions to the old buildings as a basis, designs for a new building of the same type were prepared. These plans were then turned over to Peter Kiewit's Sons, Omaha contractors, with instructions to build the factory. An estimate of the cost had been prepared and, though the cost ran somewhat over the amount the owners had been prepared to spend, it was decided to start at once.

Concrete Construction Substituted

The contractors suggested the use of concrete construction to the owner, presenting the advantages of this type of construction over the old type. But the owners were limited in the amount of funds available and felt that the present type of building would be satisfactory. Still the contractors felt that they would be rendering their client a service if they could change the type. With the cooperation of a reinforcing steel fabricator, the contractors prepared a design sketch and made estimates of the cost of fireproof construction.

The estimates placed the cost of concrete frame construction at about $300.00 more than the wood building, but, as a matter of fact, the concrete building was actually built at a cost less than that estimated for the wood building. In view of the slight additional cost, as shown by the estimates, the owner consented to have the building constructed of concrete. The result was a building with more light because the concrete skeleton construction permitted larger windows than were originally planned. The concrete design also provided greater headroom and better provision for machinery shafting.

Concrete Block Curtain Walls Effect Saving

The structure as built was of flat slab concrete design for live-loads of 250 lbs. per sq. ft. with a complete concrete skeleton and concrete block exterior curtain walls. Because the location of the building is rather isolated in a secluded spot in the Missouri River bottoms, beauty of design was a secondary feature. An accompanying illustration shows the completed structure.

An item that resulted in considerable economy was the substitution of concrete block for curtain walls instead of using brick, as originally planned. The block walls were found to cost only one half the cost of brick walls of the same thickness, resulting in a saving of approximately $1,200.00.

The new factory of the Haskins Soap Co. The cost of this structure was no greater than one of similar size with frame construction and brick exterior walls

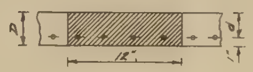
Reinforced Concrete Design Simplified

Chart I.—Reinforced Concrete Slabs

By PROF. JAMES R. GRIFFITH
Armour Institute of Technology; Assoc. M., A. S. C. E.

Joint Committee Specifications

$f'_c = 2{,}000$ lbs. per sq. in.
$f_c = 800$ lbs. per sq. in.
$f_s = 18{,}000$ lbs. per sq. in.
$n = 15$
$M = 138.7\, b\, d^2$
$A_s = 0.0089\, b\, d$



A FLOOR slab is figured as a series of beams of unit width, all poured monolithic. The unit width is usually taken as 12 in. as the live-load per square foot of floor area then becomes the beam load per foot of length.

In the use of Chart A, beams with balanced reinforcing, the dead-load weight was approximated and then corrected for final solution. Such a chart could be used for slab design but can be simplified since the beam breadth is constant.

Chart I has been so designed that the dead-load has been taken care of, thereby eliminating a good deal of trouble. This is the only chart of the series which is not entirely original. Many have no doubt seen similar ones. If the originator of this chart was known, due credit would be given. It is so adequate in its application that further simplification seems useless.

Chart I is also the only deviation, in the series, from the nomographic type of chart. Among the many names given this type of chart, my preference is "Contour Chart." Map contours are lines connecting points of equal elevation. Chart contours connect points of equal value, in this case live-load.

On the left hand side of Chart I will be found three scales for span, representing the three conditions of restraint. The formulas for figuring these different conditions of restraint were given in the May issue. At the top of each span column, the corresponding moment equation is given for identification. If a simple span is to be used, the span values in the right hand column should be used. Vertically below the intersection of the proper span and the live-load contour will be found the overall slab thickness, including 1 in. of protection. Vertically above will be found the area of steel reinforcing for each 12-in. width of slab.

As an example, take the problem of designing a balcony slab, Fig. 1-I, with a simple span of 10 ft., supported on one side by a masonry wall and on the other side by a steel channel carried by brackets. The live-load will be taken as 150 lbs. per sq. ft. Since a simple span is to be considered, the right hand span column will be used. Horizontally from a 10-ft. span to the contour of 150 lbs. per sq. ft., Chart I, and below will be seen a total slab thickness of 5.4 in., while above will be found a steel area of 0.475 sq. in. per ft. of slab.

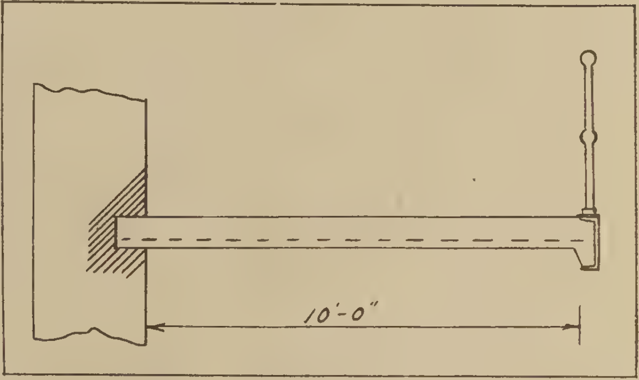


Figure 1-I

Checking the above results:

$$\text{D.L.} = \frac{5.4 \times 12}{144} \times 150 = 67.5 \text{ lbs. per ft.}$$

$$\text{L.L.} = 150$$

$$\text{Total Load } 217.5 \text{ lbs. per ft.}$$

Bending moment, $M = \dfrac{w\, l^2}{8} = \dfrac{217.5 \times 10^2 \times 12}{8} =$ 32,600 in. lbs.

Resisting moment, $M = Kbd^2 = 138.7 \times 12 \times 4.4^2 =$ 32,300 in. lbs.

Area of Steel, $A_s = pbd = 0.0089 \times 12 \times 4.4 =$ 0.47 sq. in.

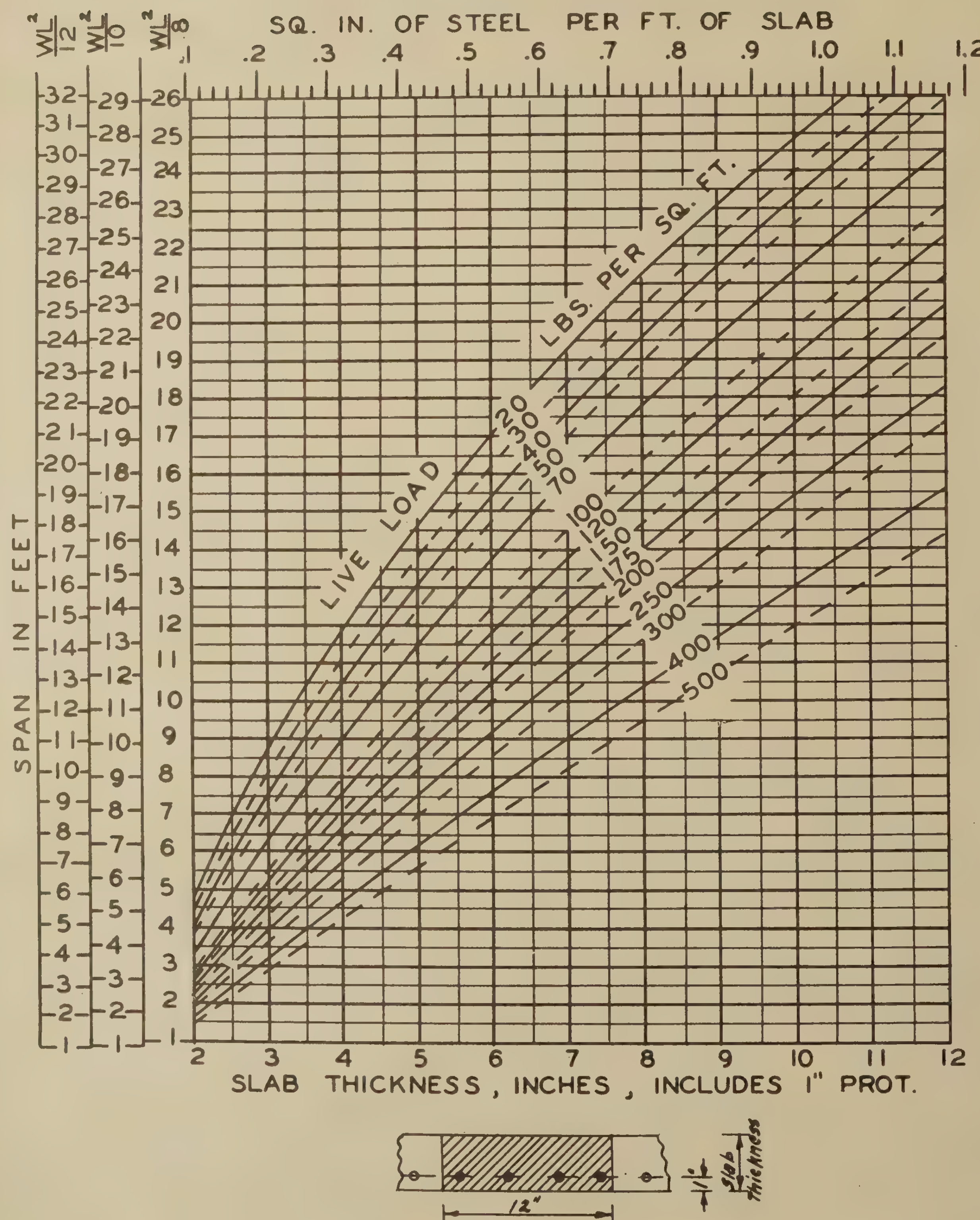
In practice, the overall depth of the slab would probably be taken to the next higher half inch, making in this case a total depth of 5.5 in. One inch of protection has been provided making the effective depth (d) of the 12-in. beam as 4.5 in. The choice of steel for slabs will be taken up in the next issue under Chart J.

The big objection to the three variable contour chart, of which Chart I is an example, is the labor in plotting. As each contour represents a series of points of equal value, sufficient points must be figured and plotted to

CHART I

Reinforced Concrete Slabs

$f_s = 18{,}000$ lbs. per sq. in.
$f_c = 800$ lbs. per sq. in.
$n = 15$



determine the location of each contour.

The equation for finding the bending moment of a simple beam under uniform load is

$$M = \frac{12\, w\, l^2}{8}$$

M is in in. lbs.
w is in lbs. per ft.
l is in ft.

But (w) represents the total load which is the sum of the dead- and live-loads.

$$w = w_{LL} + w_{DL}$$

If the overall depth of the slab is taken as (D) and the effective depth to the reinforcing as (d) with 1 in. of protection, the expression can be written for the dead-load:

$$w_{DL} = \frac{D \times b}{144} 150 = \frac{150\, D}{12} = 12.5\, D$$

The total load then becomes

$$w = w_{LL} + 12.5\, D$$

The equation for the bending moment can then be written:

$$M = \frac{12\, l^2}{8} (w_{LL} + 12.5\, D) =$$

$$1.5\, l^2 (w_{LL} + 12.5\, D) \qquad (1)$$

The resisting moment of a concrete beam with balanced reinforcing can be written

$$M = K\, b\, d^2 = 138.7 \times 12 \times (D\text{-}1)^2 = 1665\, (D\text{-}1)^2 \qquad (2)$$

Since the resisting moment must be equal to the bending moment, expressions (1) and (2) may be equated:

$$1.5\, l^2 (w_{LL} + 12.5\, D) = 1665\, (D\text{-}1)^2$$

solving for the span, we have

$$l^2 = \frac{1665\, (D\text{-}1)^2}{1.5\, (w_{LL} + 12.5\, D)} = \frac{1110\, (D\text{-}1)^2}{w_{LL} + 12.5\, D} \qquad \text{Eq. 1-I}$$

A series of tables was then prepared. In each table the live-load (w_{LL}) was given a constant value representing a contour value. This substitution resulted in an expression of two variables. In the table for each value of the live-load, various values of (D) are shown and their corresponding values of (l). Table 1-I is one such table.

Table 1-I

$w_{LL} = 20$ lbs. per sq. ft.

$$l^2 = \frac{1110\, (D\text{-}1)^2}{20 + 12.5\, D}$$

D	l^2	l
2	24.65	4.84
3	77.2	8.78
4	142.5	11.95
5	215	14.68
6	292.2	17.1
7	372	19.3
8	454	21.2
9	536	23.15
10	620	24.9
11	706	26.4
12	791	28

Plotting these values of (D) and (l) to rectangular coordinates, all points can be connected by a smooth curve representing contour $w_{LL} = 20$ lbs. per sq. ft.

The area of steel necessary for the 12-in. breadth of beam is found from the expression

$$A_s = p\, b\, d = 0.0089 \times 12 \times d = 0.1068\, (D\text{-}1)$$

Solving for (D) we have

$$D = \frac{A_s}{0.1068} + 1 \qquad \text{Eq. 2-I}$$

It will be seen, from Eq. 2-I, that the area of steel is a function of the slab depth. Two substitutions were then made:

When $A_s = 0.2$

$$D = \frac{0.2}{0.1068} + 1 = 2.875$$

When $A_s = 0.9$

$$D = \frac{0.9}{0.1068} + 1 = 9.43$$

These values will give the location of two points on the (A_s) scale. Geometric interpolation was used to get the intermediate graduations.

For any given beam section the resisting moment is a fixed value for limiting stress conditions. In order to get the span relations for the different conditions of restraint, the moments can be equated:

For partial restraint

$$\frac{w\, l^2}{8} = \frac{w\, l_2^2}{10}$$

$$l_2 = l \sqrt{\frac{10}{8}} = 1.110\, l \qquad \text{Eq. 3-I}$$

For full restraint

$$l_3 = l \sqrt{\frac{12}{8}} = 1.225\, l \qquad \text{Eq. 4-I}$$

In other words, the simple span can be increased by the factor (1.118) for partial restraint, and for full restraint by the factor (1.225).

Two substitutions were made in Eq. 3-I, for partial restraint:

When $l_2 = 2$ ft.

$$l = \frac{2}{1.118} = 1.79$$

When $l_2 = 29$ ft.

$$l = \frac{29}{1.118} = 26.95$$

This gives the location of two points on the span scale for partial restraint. Intermediate values were obtained by geometric interpolation.

Two similar substitutions were made in Eq. 4-I for full restraint.

When $l_3 = 2$ ft.

$$l = \frac{2}{1.225} = 1.632$$

When $l_3 = 30$ ft.

$$l = \frac{30}{1.225} = 24.5$$

Thus sufficient information is obtained for plotting the span scale for full restraint.

Chart I illustrates quite clearly the advantage to be gained by semi-continuous and full-continuous construction. Following down a contour of any given live-load, notice how the slab thickness, for any span, decreases for the different conditions of restraint.

Products Convention

The annual convention of the National Concrete Products Association will be held Monday, February 11th, at the Book-Cadillac Hotel, Detroit, Michigan.

The meeting will be devoted largely to the organization and reorganization of the group. (It is suggested that products men refer back to the October and November issues of CONCRETE, in which a possible reorganization was discussed.)

Practical Kinks from the Job

How to Make a Salamander

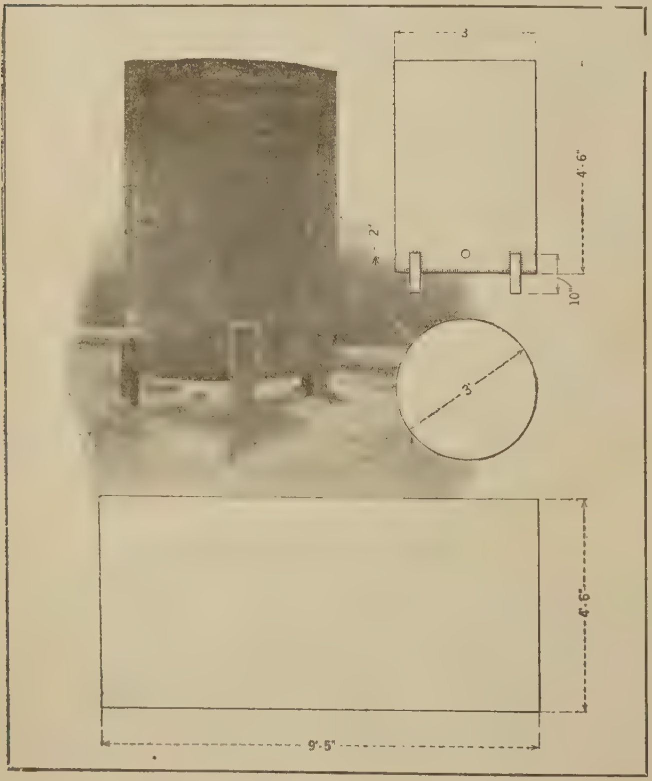
When the weather threatens frost and frost threatens destruction of the concrete work which has juet been set and laid in place, it's salamander time. Frost attacking the contained water in concrete, is liable to freeze it and thus to be injurious to proper hardening of the masonry. To offset this, it has been the practice to prevent freezing and hasten the curing of freshly poured concrete by installing salamanders. This is placed over the surface to be dried out and radiates heat while using up scrap wood and broken forms.

A salamander can be made economically by welding. A very simple type is described here with directions for its manufacture:

A section of 1/8-in. steel plate is used for the body and bottom plate. The outside measurements of the cylinder piece should be: length 9 ft. 5 in., and breadth 4 ft. 6 in. The finished salamander from a sheet of this size will be about 5 ft. high, including the legs, and about 3 ft. in diameter. Smaller salamanders can be made by reducing the measurements proportionately.

The large rectangle is rolled either in a set of plate rolls or bent around a barrel or similar object, and then the ends are tack welded together preparatory to welding the longitudinal seam. Several tack welds should be made along this seam to hold the sheet in place. The seam is then welded along the entire length, care being taken that all the tack welds are melted out and re-fused.

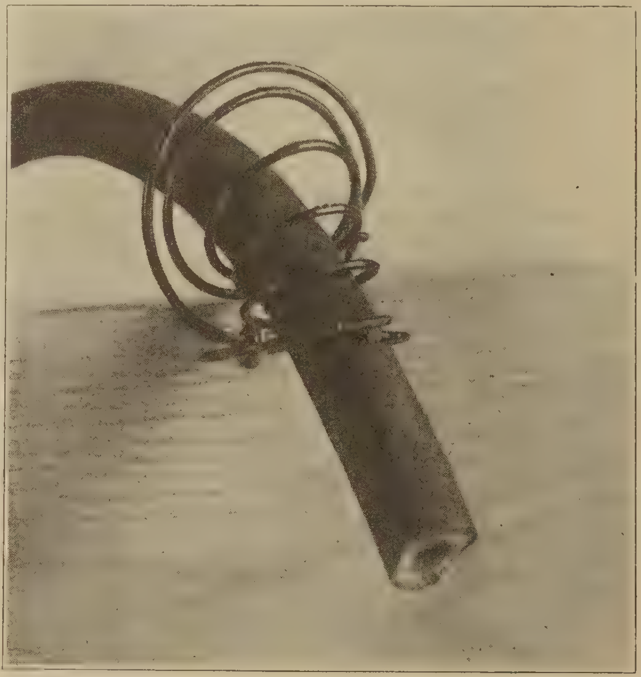
By placing the cylinder thus produced upright upon another piece of plate and marking with chalk or a prick punch around the circumference, a line can be drawn which the oxy-acetylene cutting blowpipe can follow in cutting out the bottom plate for the salamander. Cut inside the line so the bottom plate will be a little smaller in actual diameter than the cylinder itself. While the cutting blowpipe is still attached to the oxygen and acetylene cylinders, holes should be cut in the lower side of the salamander body to allow for the draft. Several of these are necessary, and they should measure about 2 in. in diameter, but can be of any shape.



Three sections of angle iron, or reinforcing steel, about 10 in. long, are used for the legs. These are welded to the lower end of the cylinder. After the welds have been allowed to cool, the legs are reheated in the oxy-acetylene flame and bent slightly outward from the body of the salamander so that by this support it will be more stable. Then all that is needed is some scrap wood and the salamander is ready for operation.

Neat Home Made Affair to Hold End of Water Hose

A hose end is a mean thing to hang up or keep over the edge of a barrel, tank or mixing trough. Take an old automobile seat spring, bend the two ends around together and fasten them with a staple as shown. Put the hose end through it. It will stay there, though quite easy to pull out when the weight of the hose is off the coils. The whole spring can be pushed over and not come above the top of the tank or barrel when not in use, if the staple is not driven down too tight. A very handy and practical little affair.



It's simple little things like these that make good kinks. Take some time, get yours on paper in some kind of shape and send it in.

Design of Concrete Pavement Mixes

A Practical Method of Designing Quality Concrete—Some Typical Pavement Concrete Problems—New Helpful Charts and Tables

By **PAUL E. KRESSLY**
Consulting Engineer, Los Angeles, Calif.

Though each of the articles published under the general title "Design of Concrete Mixes," and contributed by Mr. Kressly, constitutes a complete discussion of some phase of the problem of designing concrete mixtures, it should be considered as a separate installment in a series of articles covering the entire subject. It is from this point of view that the reader will derive the greatest benefit from them.

Attention is, therefore, called to a previous article by Mr. Kressly, published in the December issue. That article, the first in the series, discussed the matter of proportioning—both by volume and by weight. The present article continues the subject with a discussion of aggregate grading.

Mr. Kressly has had many requests for his charts and tables and he has chosen to make them available to other engineers and contractors through the pages of "Concrete." The material presented is the result of many years of successful experience in designing quality concrete and it is suggested that the articles be filed for future use.

THE size and grading of mixed aggregates is an important factor in the design of concrete mixtures. It determines the values of fineness moduli of mixed aggregates that are practical to use with certain concrete mixtures. Upon the fineness modulus of the mixed aggregate is based the range of values of fineness moduli of coarse aggregate, the percentage of fine and coarse aggregate in the mix and the water-cement ratio for various consistencies. These factors determine and control concrete strengths, provided proper attention has been given to selection of materials, mixing, placing and curing.

Therefore, it must be apparent to the designers and users of concrete, if results are to be expected, the size and grading of mixed aggregate must be controlled and maintained within the range of practical limits. In order to do this, sieve analyses of the fine and coarse aggregate should be made at the source of supply, or on the job, and the aggregate so arranged in bins that the respective quantities of each size of aggregate needed can be controlled and delivered to the mixer in the proportions necessary to produce a mixed aggregate of the specified size and grading. Diagrams 6 to 15, both inclusive, have been prepared to simplify the design and control of the size and grading of mixed aggregate. They are shown on the following page.

To determine the size and grading of mixed aggregate and the range of percentages of coarse aggregate by weight of mixed aggregate from the sieve analysis of any coarse aggregate from Diagrams 6 to 15, both inclusive, the percentages given, or to be found, must lie within the respective areas of the trapezoids shown on the diagrams by heavy black border lines. The percentage of coarse aggregate retained on the largest size sieve is determined from the lower horizontal scale of percentages, and the range of percentages of coarse aggregate by weight of mixed aggregate from the vertical scale of percentages on the right side of the respective diagrams.

Illustrative Problems

5. From the sieve analysis of coarse aggregate it is found that 46 per cent of material is retained on the 1½-in. sieve. Determine the size and grading of mixed aggregate and the range of percentages of coarse aggregate by weight of mixed aggregate.

By reference to Diagram 6, it is found that 46 per cent of material retained on the 1½-in. sieve lies within the trapezoid and that the range of percentages of coarse aggregate by weight of mixed aggregate corresponding to 46 per cent of material retained on the 1½-in. sieve is 50 to 65 per cent, and the size and grading of mixed aggregate is 0 to 3-in.

6. From the sieve analysis of a coarse aggregate it is found that 32 per cent of material is retained on 1½-in. sieve. Determine the size and grading of mixed aggregate and the range of percentages of coarse aggregate by weight of mixed aggregate.

TABLE NO. 9
To Determine Size and Grading of Mixed Aggregate

Maximum size of aggregate passing sieve size	Aggregate coarser than any sieve and percentage retained thereon.		Size and grading of mixed aggregates
	Coarser than sieve size	Per cent retained	
3 inch	1 1/2 inch	20% or more	0 to 3 inch
3 inch	1 1/2 inch	More than 10% and less than 20%	0 to 2 inch
3 inch	1 1/2 inch	From 0% to 10%	0 to 1 1/2 inch
1 1/2 inch	3/4 inch	20% or more	0 to 1 1/2 inch
1 1/2 inch	3/4 inch	More than 10% and less than 20%	0 to 1 inch
1 1/2 inch	3/4 inch	From 0% to 10%	0 to 3/4 inch
3/4 inch	3/8 inch	20% or more	0 to 3/4 inch
3/4 inch	3/8 inch	More than 10% and less than 20%	0 to 1/2 inch
3/4 inch	3/8 inch	From 0% to 10%	0 to 3/8 inch
3/8 inch	No. 4	20% or more	0 to 3/8 inch
3/8 inch	No. 4	More than 10% and less than 20%	0 to No. 3
3/8 inch	No. 4	From 0% to 10%	0 to No. 4
No. 4	No. 8	20% or more	0 to No. 4

By reference to Diagram 6, it is found that 32 per cent lies within the trapezoid, and that the range of percentages of coarse aggregate by weight of mixed aggregate is only 63 to 65 per cent. While this would produce a grading of mixed aggregate of 0 to 3-in., the range of

USE DIAGRAMS 6, 7, 8, 9, AND 10 FOR THE FOLLOWING GRADING OF AGGREGATE

Fine aggregate graded from 0 to ⅜-in.
Coarse aggregate graded from ⅜-in. to maximum size.

DIAGRAM 6

GRADING OF MIXED AGGREGATE 0 TO 3 INCH

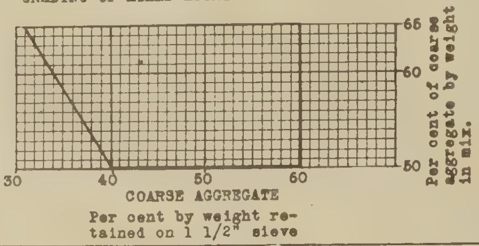


DIAGRAM 7

GRADING OF MIXED AGGREGATE 0 TO 2 INCH

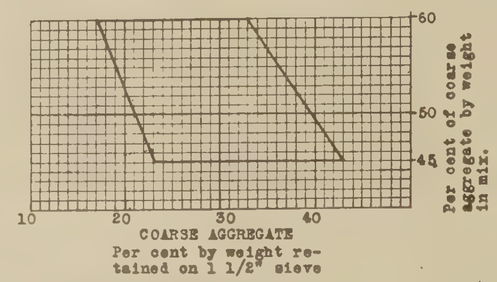


DIAGRAM 8

GRADING OF MIXED AGGREGATE 0 TO 1 1/2 INCH

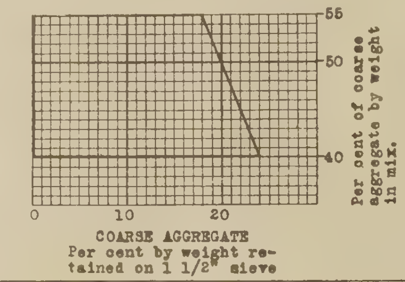


DIAGRAM 9

GRADING OF MIXED AGGREGATE 0 TO 1 1/2 INCH

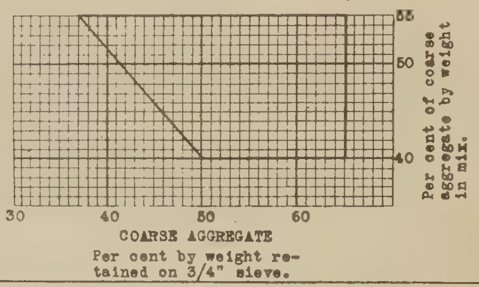
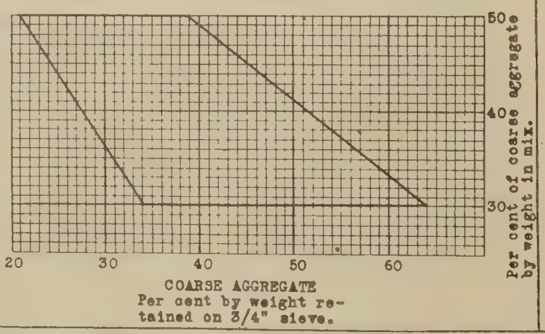


DIAGRAM 10

GRADING OF MIXED AGGREGATE 0 TO 1 INCH



USE DIAGRAMS 11, 12, 13, 14, AND 15 FOR THE FOLLOWING GRADING OF AGGREGATE

Fine aggregate graded from 0 to No. 4.
Coarse aggregate graded from No. 4 to maximum size.

DIAGRAM 11 7

GRADING OF MIXED AGGREGATE 0 TO 3 INCH

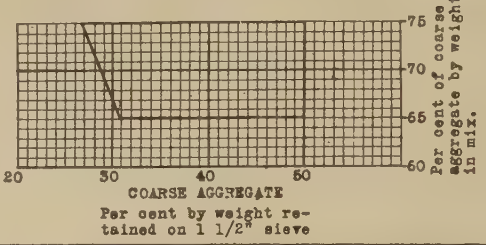


DIAGRAM 12

GRADING OF MIXED AGGREGATE 0 TO 2 INCH

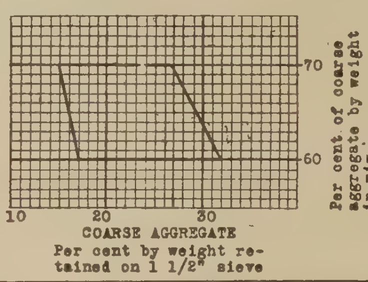


DIAGRAM 13

GRADING OF MIXED AGGREGATE 0 TO 1 1/2 INCH

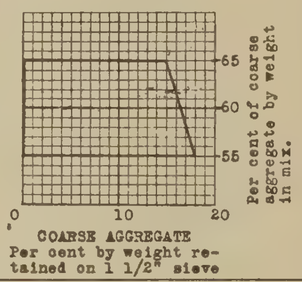


DIAGRAM 14

GRADING OF MIXED AGGREGATE 0 TO 1 1/2 INCH

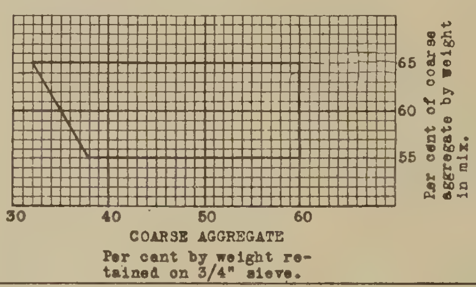
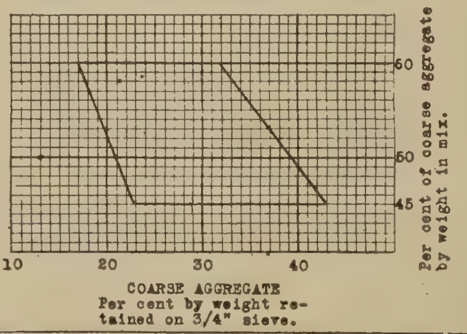


DIAGRAM 15

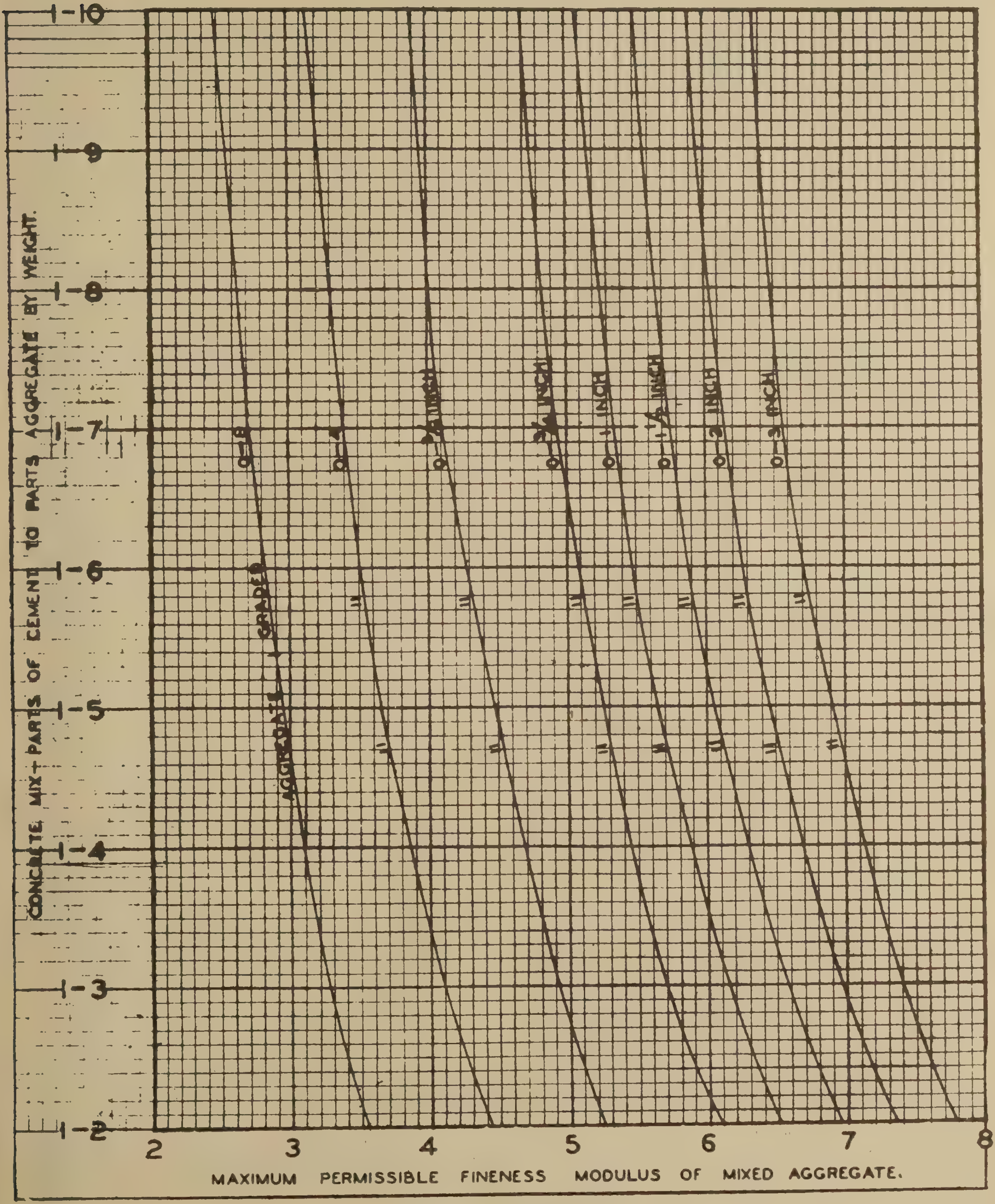
GRADING OF MIXED AGGREGATE 0 TO 1 INCH



percentages is rather limited. Referring to Diagram 7, we find that 32 per cent lies within the trapezoid and that the range of percentages of coarse aggregate by weight of mixed aggregate is from 45 to 60 per cent. This is a wider range and therefore more practical, and the grading of mixed aggregate is therefore 0 to 2-in.

DIAGRAM 16

FOR THE DETERMINATION OF MAXIMUM PERMISSIBLE VALUES OF FINENESS MODULUS OF AGGREGATE FOR VARIOUS CONCRETE MIXES AND GRADINGS OF AGGREGATE



Illustrative Problem 7

Illustrative problem in the design of concrete mixtures to show the use of the diagrams, tables, etc.

7. Assume, for this problem, that a concrete pavement is to be designed. The ultimate flexural strength to be not less than 600 lbs. per sq. in. The pavement to be hand-tamped. Acceptable sand, graded from 0 to ⅜-in. and gravel graded from ⅜-in. to 2-in. is available.

(1) The concrete will be hand-tamped, therefore, by reference to Table 1, the relative consistency may range from 105 to 110. Assume this value to be 110.

(2) Assuming that the aggregate proposed to be used will, when mixed, give a grading of 0 to 1½-in. By reference to Table 3, we find that for a mixed aggregate graded from 0 to 1½-in., relative consistency 110, using 6 bags of cement per cu. yd. of concrete in place, a concrete of a flexural strength of 610 lbs. per sq. in. can be produced, which satisfies the requirements of the design.

(3) By reference to Table 4, we find that for a grading of 0 to 1½-in. using 6 bags of cement per cu. yd. of concrete in place, the range of fineness moduli of mixed aggregate is from 5.10 to 6.00.

(4) The concrete being used for the construction of pavement, by reference to Table 5, we find that the maximum permissible fineness modulus of mixed aggregate must be reduced by 0.25. The maximum permissible fineness modulus of mixed aggregate, therefore, will be 6.00 minus 0.25 or 5.75, and the range, from 5.10 to 5.75.

(5) Suppose we select a fineness modulus of mixed aggregate of 5.60.

(6) Having determined the following values:
   (a) Relative consistency—110
   (b) Fineness modulus of mixed aggregate—5.60
   (c) Bags of cement per cubic yard of concrete in place—6.

   Referring to Diagram 1, find point of intersection of lines denoting 6 bags of cement per cu. yd. of concrete in place and fineness modulus of 5.60. Following along a line vertically downward through this point until it intersects the horizontal line giving quantity of water in gallons for a relative consistency of 100, we find this value to be 5.92 gallons. Following downward to the right, this corresponds to a value of 6.51 gallons of water required in the mix for a relative consistency of 110 and tracing vertically upward from this point we obtain a value of 0.87 for water-cement ratio.

(7) From Table 7, for a water-cement ratio of 0.87, using 6 bags of cement per cu. yd. of concrete in place, we find that 526 lbs. of dry aggregate will be required to each bag of cement.

Note: On page 46 of the December issue, in Mr. Kressly's first article, reference is made in the first line under Table No. 4 to Diagram 1. This is an error. The diagram referred to at that point is Diagram 16, published on the preceding page under the heading, "Diagram 16, for the Determination of Maximum Permissible Values of Fineness Modulus of Aggregates for Various Concrete Mixes and Gradings of Aggregate."

(8) Assuming that the sieve analysis of the sand and gravel proposed to be used, made by using Tyler's Standard Sieves, are as indicated in columns A and B in Table 10.

With a fineness modulus of sand (Column A) of 3.50 and of gravel (Column B) of 7.55 and a fineness modulus of mixed aggregate as previously determined of 5.60, refer to Diagram 4 for a grading of aggregate from 0 to 1½-in. and determine the percentage of sand by weight as follows: Along the left side of the diagram locate value of fineness modulus of sand (fine aggregate) namely, 3.50. Along the right side of the diagram locate value of fineness modulus of gravel (coarse aggregate), namely, 7.55. Draw a straight line between these points and where said line intersects the line of fineness modulus of mixed aggregate, namely, 5.60, it will be found to coincide with a percentage line having a value of 48 per cent. Therefore, 48 per cent of sand and 52 per cent of gravel will be required in the mix with the given fineness moduli of aggregates.

To determine sieve analysis of sand A, and gravel B, when combined according to the above percentages by weight, proceed as follows: For the percentage retained on any given size sieve, multiply the percentage by weight of sand retained on any given size by the percentage of sand in the mix (in this problem, 48 per cent) and add thereto the percentage by weight of gravel retained on the corresponding size sieve (in this problem, 52 per cent), the result will be the percentage of combined sand and gravel or of the mixed aggregate retained on the given size. The calculated sieve analysis of the mixed aggregate is given in Column C of the Table 10.

TABLE 10

Sieve Size	Per cent of aggregate by weight coarser than a given sieve.		
	A	B	C
	Sand	Gravel	Mixed aggregate
100	97	100	98.56
50	87	100	93.76
30	67	100	84.16
14	50	100	76.00
8	34	100	68.32
4	15	100	59.20
3/8	0	90	46.80
3/4		50	26.00
1½		15	7.80
3			
Fineness Modulus	3.50	7.55	5.60

It will be noted from Column C that the percentage retained on the 1½-in. sieve is 7.80, which by reference to Table 9 shows that we were correct in our assumption in part (2) that the grading of the mixed aggregate was from 0 to 1½-in.

(9) The weight of dry aggregate required to each bag of cement in the mix, as determined in part (7) above, is 526 lbs. The weight of sand required is 48 per cent of 526 or 252.50 lbs. The weight of gravel 52 per cent of 526 or 273.50 lbs.

TABLE NO. 11

HIGH EARLY STRENGTH CONCRETE

Ultimate values of flexural (modulus of rupture) and compressive strengths in pounds per square inch at various ages for concrete mixtures containing portland and special cements and admixtures of calcium chloride

The values of strengths in the above table are based upon strengths at or below the minimum strengths obtained by actual tests.

It is not recommended that sea water be used in mixing concrete as tests have not been made to determine the effect of age on the strength of concrete in which sea water has been used.

Bags of cement per cu. yd. of concrete in place	Size and grading of mixed aggregate	Cement	Admixture	Mixing water.	Flexural strength in pounds per square inch.				Compressive strength in pounds per square inch.			
					Age				Age			
					24 hrs.	3 days	7 days	28 days	24 hrs.	3 days	7 days	28 days
6	0 to 3"	Lumnite	none	Fresh	650			700	4000			4500
6	0 to 2"	Lumnite	none	Fresh	675			750	4200			4700
6	0 to 1½"	Lumnite	none	Fresh	750			850	4500			6000
6 1/2	0 to 1½"	Oil Well	2% calcium chloride.	Fresh	350	450	600	700	1800	2500	3500	4200
6 1/2	0 to 1½"	Oil Well	none	Fresh	270	450	600	700	1200	2500	3500	4200
6 1/2	0 to 1½"	Portland	2% calcium chloride.	Fresh	200	400	500	650	800	2200	3000	4000
6 1/2	0 to 1½"	Portland	none	Fresh		325	500	650		1400	3000	4000
6 1/2	0 to 1½"	Hydro-plastic	none	Fresh		325	350	450		1400	2000	2500
6 1/2	0 to 1½"	Portland	none	Sea Water	250	450	650		1000	2500	4000	
6 1/2	0 to 1½"	Oil Well	none	Sea Water	300	525	650		1200	3300	4000	

(10) Assuming that the sand contains 4 per cent by weight of free water, the weight of sand in the mix will therefore be 4 per cent of 252.50 lbs. plus 252.50 lbs. or 262.60 lbs.; the gravel contains 2 per cent by weight of free water, the weight of gravel in the mix will therefore be 2 per cent of 273.50 plus 273.50 lbs. or 278.99 lbs.

(11) There is 4 per cent of 252.50 lbs. or 10.10 lbs. of free water in the sand or approximately 1.20 gallons. Two per cent of 273.50, or 5.47 lbs. of free water in the gravel, or approximately 0.65 gallons. The total free water contained in sand and gravel is therefore 1.20 plus 0.65 or 1.85 gallons. In part (6) it was determined that 6.51 gallons of water would be required in the mix, so that the quantity of water that must be added to the mix is 6.51 minus 1.85, or 4.66 gallons.

Illustrative Problem 8

It is desired to design a concrete mixture using a mixed aggregate graded from 0 to 3-in. The aggregates available are a finely graded sand having a fineness modulus of 2.30, sieve analysis as shown in Column A, Table 12; pea-gravel having a fineness modulus of 5.20, sieve analysis as shown in Column B, Table 12; a coarse aggregate having a fineness modulus of 7.20, sieve analysis as shown in Column C, Table 12, and a coarse aggregate, of which all of the material is retained on a ¾-in. sieve, having a fineness modulus of 8.80, sieve analysis as shown in Column D, Table 12.

It is evident by an examination of the sieve analysis that no combination of the fine aggregates "A" or "B" with coarse aggregates "C" or "D" will produce a well-graded mixed aggregate of the size and grading desired. Suppose we combine all four aggregates and see whether a good grading of mixed aggregate can be obtained.

Before the problem can be solved, it is necessary to select values of fineness moduli of fine, coarse and mixed aggregates. For the fine aggregate we will combine aggregates A and B and for coarse aggregate, aggregates C and D. By reference to Diagram 2, for 0 to 3-in. grading, the range of values of fineness moduli for coarse aggregate is 8.0 to 8.6; fine aggregate 2.0 to 4.0, and mixed aggregate 5.8 to 7.00, and from these we will select the following values:

Fineness modulus of fine aggregate, 3.50
Fineness modulus of coarse aggregate, 8.20
Fineness modulus of mixed aggregate, 6.20

From Diagram 2 determine the percentages of fine aggregate (F.M. 3.50) and coarse aggregate (F.M. 8.20) necessary to produce the selected fineness modulus of mixed aggregate, namely, 6.20. These percentages we find to be fine aggregate (F.M. 3.50) 42 per cent, and coarse aggregate (F.M. 8.20) 58 per cent.

TABLE NO. 12

Sieve Analysis of Aggregates

Sieve size	Per cent by weight coarser than a given sieve								
	A	B	C	D	A_m	B_m	C_m	D_m	Mixed aggregate E
100	94	100	100	100	23.5	17	22	36	98.5
50	76	100	100	100	19.0	17	22	36	94.0
30	40	96	100	100	10.0	16.3	22	36	84.3
14	16	92	100	100	4.0	15.6	22	36	77.6
8	4	82	100	100	1.0	13.9	22	36	72.9
4		50	100	100		8.5	22	36	66.5
3/8			80	100			17.6	36	53.6
3/4			30	100			6.6	36	42.6
1 1/2			10	80			2.2	28.8	31.0
3									
F. M.	2.30	5.20	7.20	8.80					6.21
	25%	17%	22%	36%	Per cent by weight of each aggregate in mix.				

Combining fine aggregates—Column A, fineness modulus 2.30 and Column B, fineness modulus 5.20 to produce a mixed fine aggregate having a fineness modulus of 3.50 selected above, the percentages of aggregates A and B required in the mix to produce a mixed fine aggregate having a fineness modulus of 3.50, can be determined from Diagram 2, and find that we require 59 per cent of A and 41 per cent of B.

Combining coarse aggregate—Column C, fineness modulus 7.20 and Column D, fineness modulus 8.80 to produce a mixed coarse aggregate having a fineness modulus of 8.20 selected above, the percentages of aggregates "C" and "D" required in the mix to produce a mixed coarse aggregate having a fineness modulus of 8.20 can be determined from Diagram 2, and we find that we require 38 per cent of "C" and 62 per cent of "D."

The percentage of total fine aggregates "A" and "B" in the mixed aggregate, as determined above, is 42 per cent. Of this percentage, there will be required of aggregate "A" 59 per cent of 42 or 25 per cent in the mixed aggregate and of "B," 41 per cent of 42 or 17 per cent in the mixed aggregate.

The percentage of total coarse aggregates "C" and "D" in the mixed aggregate, as determined above, is 58 per cent. Of this percentage there will be required of aggregate "C," 38 per cent of 58 or 22 per cent, in the mixed aggregate and of "D," 62 per cent of 58 or 36 per cent in the mixed aggregate. Therefore the individual percentages of the various aggregates required in the mixed aggregate to produce a fineness modulus of 6.20 are as follows:

Aggregate "A"—25 per cent.
Aggregate "B"—17 per cent.
Aggregate "C"—22 per cent.
Aggregate "D"—36 per cent.

To determine the sieve analysis of the mixed aggregate, we multiply the percentages coarser than the various sieve sizes in the analysis of the individual aggregates "A," "B," "C," "D" by the respective percentages of the various aggregates required in the mixed aggregate, namely, 25, 17, 22 and 36 per cent respectively, giving the percentages coarser than a given sieve of the respective individual aggregates as shown in Columns Am, Bm, Cm and Dm in the Table. The sieve analysis of the mixed aggregate is the summation of the respective percentages coarser than the given sieve sizes, as shown in Column E of the Table. The fineness modulus of mixed aggregate as determined from the percentages is 6.21. This value checks close enough for practical purposes with the selected value, namely, 6.20.

Harold Teen an' tha Concrete Airport

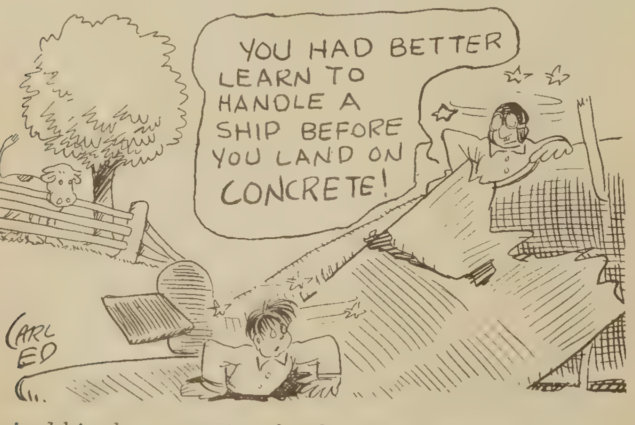
By "CHUCK" E. BABBS

HAROLD TEEN wuz a nize boy. Yes Sir! Hiz mother sed so.

Outside uv bein' crazy, insane, a nut and a fanatic about Lillums, aviation, football, Leapin' Lena and gedunk sundaes, he wuz a normal, typical American boy.

He played with airplanes before Linburg spanned tha Atlantic. He wuz an extremely uncouncious—er—I mean, air concious lad. Why, he wuz thrown out uv tha Aviation School office so often, that thay constructed a 12- by 12-ft. concrete apron, outside tha window nearest the manager's desk fur Harold to land on!

After many unsuccessful attempts to become a student flier without tha knowledge uv hiz parents, hiz father surprised him by suggesting that he shood learn ta fly! Emagine Harold's surprise and delight! He mashed dadly over ta Lillum's ta acquaint her with tha strange, but pleasant facts.


YOU HAD BETTER LEARN TO HANDLE A SHIP BEFORE YOU LAND ON CONCRETE!
CARL ED

Uz Harold watched a plane go up, he received a face full uv dust and dirt, blown at him by tha wind frum tha prop. Bente, the instructor, helped Harold extract a specimen uv mother earth from one uv hiz eyes.

Tha little incident uv tha eye, set Harold ta thinking very hard, why I'll be a son uv a cocoanut tosser, he mused, if spectators and mechanics shood receive tha terra firma forced at them by tha propeller! This shood bee remedied, he thot, why coodn't somethin' smooth be used fur runways like sidewalks? Ah! That wuz them! Concrete! Why coodn't concrete runways bee constructed? The moor hee thot uv this idea, tha better he liked ut.

He immediately thot uv the Portland Cement Association. "They shood be abul ta help me," he thot as they promote tha use uv cement fur permanent fiur proof structures.

Harold visited E. K. Smith, tha Concrete Runway Engineer, and wuz interviewed by him in hiz office on tha fifth flore.

Mr. Smith proceeded ta show Harold Teen why concrete iz tha best and tha most permanent kind uv runways ta feature at a airport. He wuz also shown that tha concrete runways cood bee moor economically constructed than any uther type uv runways.

Harold returned ta C———, fully convinced that concrete runways wuz tha best and tha most modern available. He finally succeeded in "selling" tha idea ta tha Mayor, and tha permanent runways wuz decided upon.

Bente wuz delighted with tha idea, and he heartily approved uv thoze fine concrete runways! In fact, he wuz so pleezed that when tha number uv pupils at hiz Flyin' School increased, he appointed Harold as hiz assistant.

And it came to pass that Harold Teen wuz a successful flyer, an amachoor ingineer, and flyin' instructor and an airport manager.

The Mayor of C———, Harold Teen and Bente, graciously acknowledged tha assistance given them by Mr. Smith because tha C——— Municipal Airport was one, big, large, immense, monstrous, huge success! Hot Tailspins!

First Florida Road Builders Show in Spring

The First Florida Road Builders show and conference will be held in Jacksonville March 19th to 23rd, President J. J. Hedrick of the Florida Road Builders Association announced following co-ordination of the efforts of the several interested agencies.

While the show will be known as the Florida Road Builders Show and Conference, it is not the intention of the association to limit either visitors or exhibitors to this state, and invitations are being directed to state highway departments, county commissioners, city and county engineers throughout the Southeast. Eight states will be covered in the invitations, as follows: Florida, Georgia, Alabama, Mississippi, Tennessee, Virginia, North and South Carolina.

The conference which will be held will be a school for road builders, with many prominent speakers on the various subjects of interest to contractors, engineers, and public officials handling road contracts. On the executive committee of the association are representatives of each of the groups and organizations co-operating in the enterprise.

Besides exhibits, there will be a demonstration field where road building machinery of every description may be put into actual operation and many special features are being prepared.

The engineering department and extension division of the University of Florida, the state road department, the Florida Engineering Society, the Florida Paving Contractors Association, the Jacksonville Chamber of Commerce and various groups of material and equipment men, are co-operating.

Northwest Products Men Plan Next Annual Convention

Steps to enlarge the scope and usefulness of the Northwest Concrete Products Association are to be taken when this association meets at Eugene, Oregon, on January 25th and 26th, in its annual convention.

Results of research work within the industry, and of the many investigations recently conducted in this section, will also be brought before the assembled membership.

Howard E. Hall, of the Eugene Concrete Pipe Company, is the general convention chairman, and has stimulated the work of the various committees toward forming a comprehensive program of inspirational and technical talks, with entertainment features.

The program itself has been in the hands of W. J. MacKenzie, of the Tuerck-MacKenzie Company of Portland, Ore., chairman of the program committee. One of the leading speakers which he has secured to fill a prominent part at one of the sessions is J. E. Jellick, Pacific Coast manager of the Portland Cement Association.

1928 Shows Increase of Four Per Cent in Construction

Moving steadily toward establishment of 1928 as a record-breaking construction year, building operations in November held a pace never before equalled in that month, according to D. A. Garber, general manager of the Associated General Contractors of America.

New construction started in the 37 states east of the Rocky Mountains during the first eleven months of this year, amounting to $6,195,529,800, shows an increase of 6 per cent over the amount started during the corresponding period of last year, according to F. W. Dodge Corporation. The territory covered in the 37 states represents about 91 per cent of the country's total construction.

"Statistics covering all types of construction show the volume of construction activities during the first eleven months of this year to be more than four per cent greater than the total for the corresponding period of 1927," Mr. Garber declared in a statement issued recently. The figures are based upon actual shipments of basic construction materials.

"Expectations that a new record will be set this year are bolstered by the fact that the volume of contracts awarded during October was the highest ever registered for that month of the year. Much of the work to be done under the October contracts will actually be under way during the closing days of the year," the statement declares.

November activities held virtually the same plane occupied by operations during the peak mid-summer months of three and four years ago. Only three months in 1926 and 1927 established higher records.

Pennsylvania's Highway Equipment

The Pennsylvania highway department's great amount of equipment for road construction and maintenance and snow removal has reached such proportions that it requires more storage room than the state owns and the renting of space in some districts has become necessary.

During the fall of the past year the department has been building on state-owned property 23 storage sheds of approved fireproof design. They are for year-round use and equipped with offices for the use of maintenance superintendents.

Coming Conventions

American Concrete Institute—February 12th to 14th. Twenty-fifth annual convention, at the Book-Cadillac Hotel, Detroit, Mich.

American Concrete Pipe Association—February 14th to 16th. Annual convention, at the Book-Cadillac Hotel, Detroit, Mich.

American Road Builders Association—January 14th to 19th. Convention and road show, at the Cleveland Public Auditorium, Cleveland, Ohio.

Association of Cast Stone Manufacturers—February 13th. First annual meeting, at the Book-Cadillac Hotel, Detroit, Mich.

Iowa Concrete Products Association—January 29th and 30th. Annual convention, at Des Moines.

National Concrete Products Association—February 11th. Annual convention, at the Book-Cadillac Hotel, Detroit, Mich.

Nebraska Concrete Products Association—January 24th. Annual meeting, at the Lincoln Hotel, Lincoln, Nebr.

Northwest Concrete Products Association January 25th and 26th. Fourth annual convention, at the Eugene Hotel, Eugene, Oregon.

Wisconsin Concrete Products Association—January 10th and 11th. Annual convention at the Hotel Plankinton, Milwaukee.

Economical Form System

(Continued from page 30)

labor-saving consideration in stripping but it also minimizes the breakage and labor necessary for the repairing of forms for further use.

A Typical Example

To show just how this system is handled, the various steps encountered in planning work on an actual job, the Gary State Bank, Gary, Ind., will be shown. The following will illustrate the methods used.

After becoming familiar with the plans and specifications of the proposed building it was then necessary to examine the various schemes of form construction adaptable to this particular project. The procedure followed was to draw cross sections through typical panels and develop these with the various adaptable schemes, (as shown in Figure 1.) There are certain definite considera-

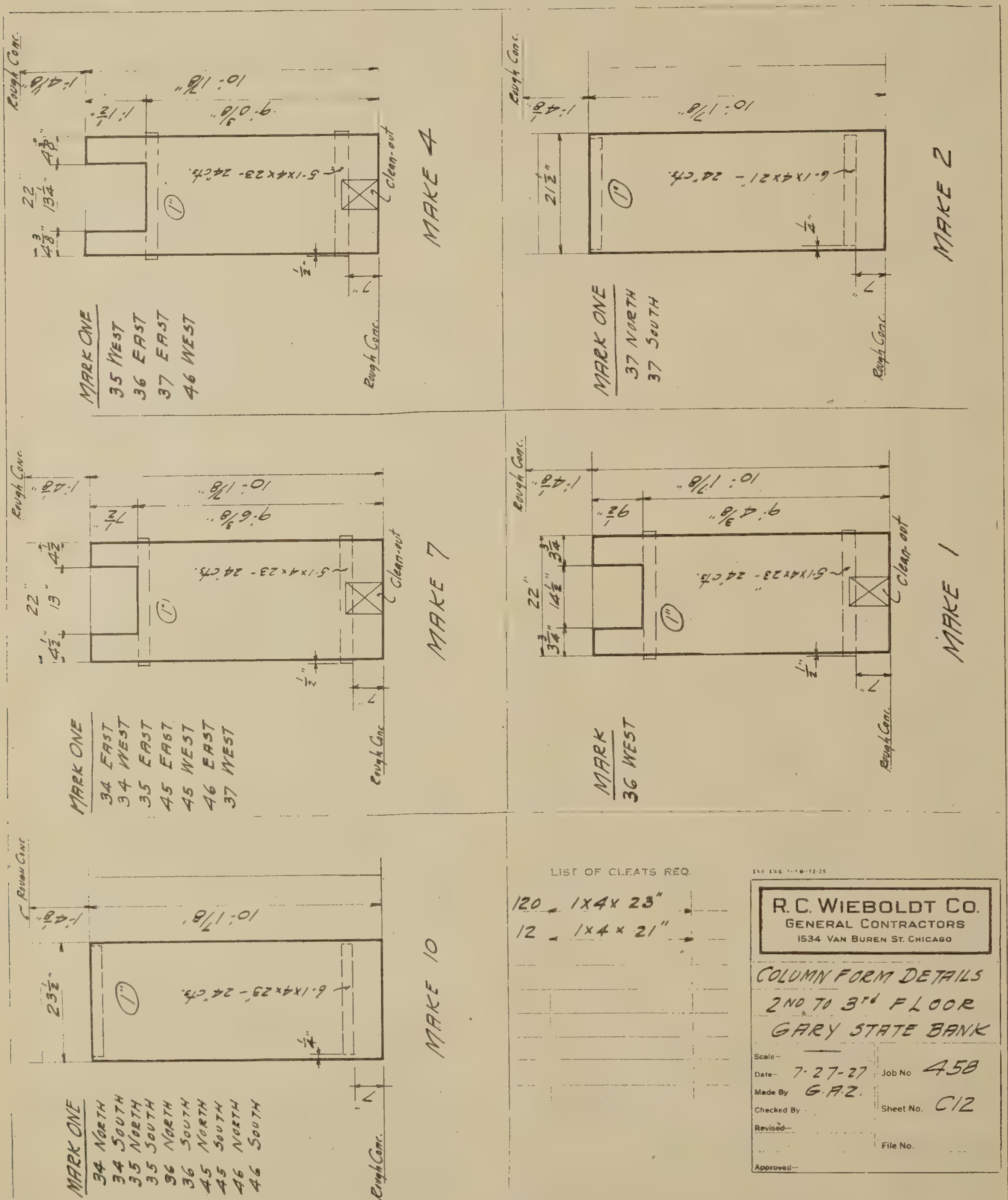


Figure 6

tions that must be made in ascertaining the best and most economical scheme to be used for any particular job:

1. The speed of construction.
2. The season of the year.
3. Lumber on hand or available.
4. The estimated cost based on the lumber and labor involved.

Only such lumber sizes should be used in any form scheme that can be readily put to other uses and also permit the greatest salvage. In the design of the forms for the Gary State Bank at Gary, Indiana, three different schemes were considered. In all three schemes the method of hanging beam forms was practically the same. The differences were mainly in the spacing of ¼-inch round wires and the size of beam bottom cleats.

Scheme 1, which is the most commonly used for concrete joist construction, involved the least lumber, requiring 2.06 bd. ft. per sq. ft. of slab. Scheme 2 lent itself to speedy erection of forms and of closing in for temporary heating under winter conditions. The shores and the girt under this scheme are erected just before concreting. This system, however, called for 2.41 bd. ft. of lumber per sq. ft. of slab. Scheme 3 permitted the use of short lengths of lumber. It was possible under this scheme to use but three different soffits to do the entire job, but 2.47 bd. ft. of lumber per sq. ft. of slab would have been needed. After a thorough consideration Scheme 1 was adopted. Within the last year the method of hanging beam bottom forms has been changing from wires to ½-inch 14 gauge straps carried from the top flange by means of a casting or pressed steel clamps. These methods eliminate the use of a temporary scaffold for the tightening of buttons during erection and speed up the hanging of bottoms.

With the general scheme of floor construction adopted and designed for the various special conditions, the actual detailing of forms was started. The first operation was the preparing of a Form Erection Plan for each different floor. The second operation was that of shop detailing the individual units, such as beam bottoms, beam sides and column sides, in the order that they would be erected in place.

The Erection Plan

The form erection plan (see Figure 2) was traced from the structural or steel erection plan showing all steel beams, girders, columns and openings; column designations were given and circled to distinguish them from the column sizes; beams, girders and spandrels were dimensioned to column center lines; slab thicknesses were shown in each panel indicating by arrow the direction of the span of concrete joists; column fireproofing sizes were worked out by taking the actual dimensions of the structural steel column from the structural steel shop details and adding to this the fireproofing required by ordinance; the overall concrete dimensions of columns were shown on the plan and given in inches; structural shop details were studied for wind bracing, brackets and so forth that would decide lengths of beam bottoms; the general plans were consulted for any depressions for marble, tile, and the like; various finished floor thicknesses, all special requirements such as found at stairs, elevators, shafts, etc., where finished plaster lines will often decide the fireproofing for some beams and girders.

Along the top of the sheet, cross sections are drawn of each different beam with fireproofing and designated in alphabetical order. All concrete dimensions are given in relation to the finished floor line and with center line of steel beams if not symmetrical. Steel beams are shown in their relation to the finished floor lines giving their sizes and weights. All beams on plan having the identical cross section are given the corresponding letter as part of their designation. Numerals are added to complete this designation when the beam forms are being shop detailed. Beams with like designations are identical in all respects and the forms are interchangeable.

The shoring scheme is then shown on the plan, either in part if typical throughout, or in its entirety if that particular floor demands it. The north direction is added. The form erection plan need not be to scale but the cross sections should be shown in relative proportion. In general the form erection plan should be complete in its information so that it is possible to do all the shop detailing of beam bottoms and sides without the need of referring to any other plan.

Beam Schedules

Beam bottom forms were next listed in alphabetical order on a printed form (see Figure 3) that provides for 50 different kinds. The mark of beam corresponds to beam or beams of like designation on the form erection plan. Lengths and widths given for beam bottoms are actual dimensions for fabrication. The dimensions to the left and right of the beam bottom lengths are for convenience in erecting and also represent the allowances made in arriving at the actual length of beam bottom.

Beam sides of one width and length and without any other further notching were then listed on a form similar to the beam bottom details (see Figure 4.) The first column designates the particular beam side by annexing the letter for direction. For example, B1S would designate the south beam side of beam B1. When the sides are fabricated the marking would read B1 South. It is evident that with the beam bottom details made, the listing of the beam sides is greatly simplified, as most of the allowances and lengths are the same as those of the corresponding beam bottoms.

Irregular beam sides were next detailed on a printed form showing 7 rectangles with dimension lines along the left and top, (as shown in Figure 5).

Column Schedules

Column sides were finally detailed on the same form as the irregular beam sides (see Figure 6). The top of the column form is given in relation to the rough concrete floor line to show the allowance made in determining its height. The total number to be made of each kind is given below. To the left of the detail is given the marking. Grouping the identical sides helps toward making in lots rather than for particular column requirements The shop detail forms are usually printed on tracing paper 14 in. by 20 in. in size. All work is done in soft pencil to get the best results in blue-printing.

The detail drawings and the schedules were then sent to the shop, the forms fabricated at that point, and the finished forms then shipped to the job where they were erected without trouble.

Prohibit Salt Water Dripping on Pennsylvania Highways

Laboratory tests made by the Pennsylvania Highway department have shown conclusively that sodium chloride or common salt has a deleterious effect upon concrete. The department has therefore decided that ice cream trucks and similar vehicles which drip salt water upon pavements of the state's highways will not be allowed to use them.

A law has been invoked providing a penalty for a vehicle so constructed or loaded as to allow the contents dropping, leaking, or otherwise escaping.

1928 Accomplishments in Concrete Pavement Construction

(Continued from Page 16)

5. In construction of concrete pavements provision should be made for high early strength concrete where traffic demands early opening of pavement.
6. The crown of a two-lane pavement shall be 1 in.
7. In the construction of concrete pavements the proportioning of aggregates should be specified by weight measures rather than by volumetric measure.

It will be noted that the provision regarding proportioning by weight coincides with the recommendations of the U. S. Bureau of Roads and with the practice in many states. Though these provisions are not obligatory, they represent the joint opinion of the most responsible organizations concerned with highway construction and as such are of great importance to highway engineers and contractors.

Concrete Testing Methods

Reports from state highway departments indicate quite a difference of opinion regarding the type of test that gives the best indication of the quality of the concrete going into the pavement. Many engineers consider that no one test tells the whole story and, as a result, they use several tests as, for instance, the modulus of rupture and the compression tests. Though some of the engineers still rely exclusively on the cylinder compression tests, by far the greater number favor the beam, or modulus of rupture test, as indicating most accurately the quality of the concrete desired and as being the most practical under average field conditions. They feel that the beam tests can be made up in sufficient numbers to give an accurate indication of quality and that beams are more easily made and tested. Another advantage of the beam test is that it can easily be used to give an indication as to when the road can be opened to traffic. This is of special importance when precautions are taken to obtain a high early strength concrete.

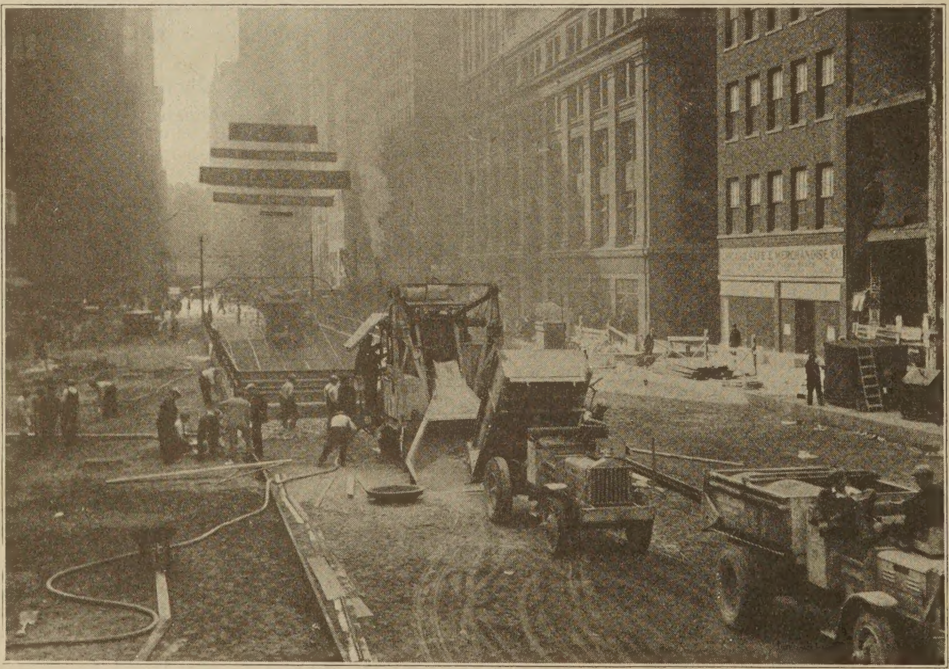
A significant indication in the reports is that highway engineers are thinking of quality of concrete as not only associated with strength, but with other qualities as well. The ability of the concrete to withstand traffic and weather is the quality sought. Low absorption, density and durability are mentioned as the most important requirements in some reports. The highway engineer, in common with all other concretors, is shifting his attention from strength as the only indication of quality to other factors that may have a definite influence on satisfactory performance.

Proportioning by Weight

One of the notable changes in construction practices during the past few years has been the trend toward proportioning aggregates by weight rather than by volume. During 1927 only seven states proportioned aggregates by weight, while in 1928 at least sixteen states either required that aggregates be proportioned by weight or made this method optional. At least four additional states are expecting to add this feature to their 1929 pavement specifications, and highway engineers in general are giving this method favorable consideration.

The trend toward proportioning by weight is in accord with the recommendations made by the U. S. Bureau of Public Roads and by the American Association of Highway Officials, as reported above. It is reasonable to expect that this trend will continue and that each year new highway departments will specify weight measurement of aggregates.

Another development in proportioning aggregates is a trend toward the practice of combining coarse aggregates of various sizes in certain definite proportions so as to approach more nearly the ideal grading sought. All highway departments emphasize proper grading of aggregates and at least three states have put down pavements in which several sizes of coarse aggregates were combined in definite proportions. Several states indicate that they will adopt such a policy in the near future.


The outstanding example of concrete paving construction in big cities during the past year, was the widening and repaving of La Salle St. in Chicago's "loop"

Street Pavement Construction

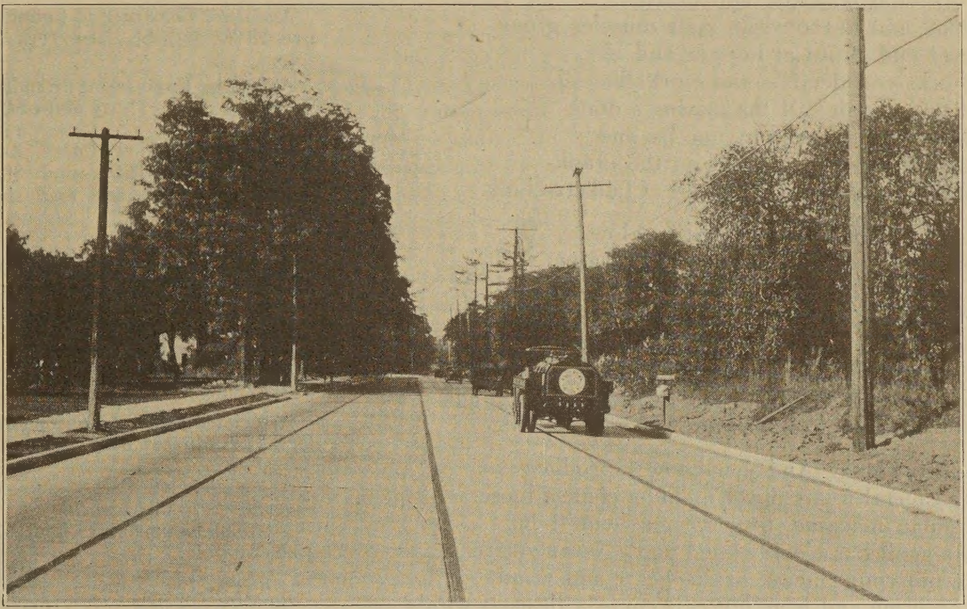
Progress in construction methods used in building street pavements has been very much slower than in highway construction, though in this branch, also, some progress may be seen. The most significant indication of better methods is the trend toward the use of finishing machines. During the past year more concrete street pavements were finished mechanically than ever before and a further adoption of this method is expected. City officials are placing more emphasis on the need for even surfaces.

A recent survey of street paving specifications made by L. S. Trainor and reported before the recent meeting of the American Society for Municipal Improvements brings out the fact that "only about 50 per cent of the specifications studied showed a trend toward modernization, while the remainder are out of date." Captain Whitehurst, assistant engineer commissioner of Washington, D. C., in a recent address stressed the fact that inspection on city pavement work in a number of cities visited was lamentably inefficient. The result of these conditions is that city street paving has not reached the high state of development in construction methods that characterizes most state highway work.

There are, of course, many exceptions to this condition, and many cities are securing excellent work. In these cities the principles of making quality concrete, combined with modern, up-to-date pavement design give the taxpayers full value. The reason for this lack of equal progress is probably influenced by political conditions. Whatever the cause, there is much room for further improvement in street paving and the advances being made are indicative of greater and more general advances that are still to come.

The use of longitudinal construction joints, dividing the street pavement into parallel strips is increasing. When such joints are properly designed and constructed, they are of benefit. Also, the practice of increasing the depth of the pavement slab at the sides of the street and at the longitudinal joints is resulting in better street pavements. As is the case in road construction, street pavements that are built in strips by the part-at-a-time method carry with them the advantages of easier finishing. When pavements are built in narrower strips, say from 10 to 20 feet wide, finishing machines can be used and even when hand finishing methods are used, the results are better. This type of construction also makes the use of longitudinal joints necessary and results in other advantages. Engineers who have had much experience in the construction of concrete streets recommend that no single slab unit be wider than 20 ft.

In street pavements, as in highway pavements, there is a definite trend toward the practice of designing the slab for the traffic it will bear, both as regards the thickness and the width of the pavement. Streets in industrial districts where there is much heavy truck traffic require a different design than purely residential streets or parkway boulevards. It is poor economy to build a street pavement heavier than is needed and it is poor economy to build it too light.



Another 1928 *example of the trend toward wider highways. This is U. S. Highway No.* 20, *near Cleveland, Ohio*

What of 1929?

From every viewpoint, therefore, the year 1928 has seen a definite step forward. Volume has increased and quality of construction has increased. There are now, at the beginning of 1929, more concrete roads and streets serving the motorist, the farmer and the manufacturer that the concretor can point to with pride than there have ever been before. The progress made in the quality of the work cannot help but continue and to recognize the need for further progress is the first step toward attaining it.

Available Funds Greater

Funds are available for a continuation of the pace established in 1928. Bond issues voted during 1928 in four states—Iowa, West Virginia, Louisiana and Missouri—total $260,000,000 for road and bridge improvement. In addition there are new county and city funds available, which, with funds held over from previous years, makes a total equaling if not exceeding 1928. The country has sort of settled down to a more or less uniform rate of street and highway improvement and it is probable that 1929 will see an equal, if not slightly greater, volume of concrete pavement construction than in the year just passed.

And there will be an ever increasing tendency toward better construction methods. Each year a greater mileage of pavement will be placed under methods that will insure smoother, stronger and more durable concrete.

Mixer Musings

Reported by "Joe"—The Mixer Boss.

(Patscrap. Rymes of a Roughneck)

The Song of the Mixer

Clankety-clank, rattle and moan,
Bend and heave while your muscles groan,
Shovel and strain at hopper and bin,—
Work, you devil!—and work like sin.
Spit and cough 'till the mixing's done
Wheel up the incline, one by one
Engine is missing—'Twist on the crank
Make my drum roll again! Clankety-clank.

Clankety-clank till the whistles blow,
Mix right on in the floor light's glow.
No meaning to night. No meaning to day.
Mountains of Labor. Molehills of play.
Feed me fine aggregate, cement and rock,
The while I roll on like the cogs of a clock.
From my iron mouth to the clean forms of plank
Soft stone I'm depositing. Clankety-clank.

Clankety-clank. And you know I produce
Till metal wears down or bolts come-a-loose.
A human machine, to serve me—you'll be.
My spell has o'erwhelmed you. Never go free!
Give me your sinews, brain, heart and mind.
Leave me and hear my call come with each wind.
Mine is the ocean in which many sank,
But he-men sailed thru,—and won. Clankety-clank.

—PAT O'LEARY.

ANOTHER year
* * *
HAS passed into
* * *
OBLIVION and
* * *
A NEW YEAR
* * *
LIES before us
* * *
TO DO with
* * *
AS WE will.
* * *
IT'S up to us
* * *
TO MAKE 1929
* * *
WHAT we want it to be.
* * *
LET'S make it the
* * *
BEST year that
* * *
EVER happened.
* * *
WHAT SAY?

Joe, the Mixer Boss.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.

Twenty-fifth annual convention, Book-Cadillac hotel, Detroit, Mich., Feb. 12th to 14th.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

Twenty-second annual convention, Book-Cadillac Hotel, Detroit, Mich., Feb. 14th to 16th.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 W. Thirty-ninth St., New York City.

American Road Builders' Association; Miss E. A. Birchland, Secretary, 29 W. Thirty-ninth St., New York City.

1929 convention and road show, Cleveland, Ohio, Jan. 14th to 19th.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer, Secretary, 1150 Munsey Bldg., Washington, D. C.

Association of Cast Stone Manufacturers; Frank M. Brooks, Secretary, Pasadena. Calif.

First annual meeting, Book-Cadillac Hotel, Detroit, Mich., Feb. 13th.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Concrete Products Association; F. O. Matthiessen, Secretary, 644 Drexel Building, Philadelphia, Pa.

Annual convention, Book-Cadillac Hotel, Detroit, Mich., Feb. 13th.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.

Iowa Concrete Products Association; R. L. Gavin, Secretary-Treasurer, 1002 Hubbell Bldg., Des Moines, Iowa.

National Association of Builders' Exchanges; Earl F. Stokes, Secretary, 15 E. Fayette St., Baltimore, Md.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

The National Lime Association, Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N.W., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 432 Munsey Building, Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 937 Leader Building, Cleveland, Ohio.

Northwest Concrete Products Association; F. R. Zaugg, Executive Secretary, 803 Seaboard Building, Seattle, Wash.

Fourth annual convention, Eugene Hotel, Eugene, Oregon, Jan. 25th and 26th.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.

Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer. 3115 Plankinton Arcade, Milwaukee, Wisconsin.

Annual Convention, Plankinton Hotel, Milwaukee, Jan. 10th and 11th.